

Note: The AC1 contains responses to both reviewers.

Responses to the reviewers are provided below in bold.

Reviewer 1

Review of Global Ocean Data Set of Marine Aerosol Properties

This paper brings together atmospheric and oceanic measurements from 25 cruises, since 1991. Together, this is a very impressive set of data, and it will be very helpful to the broader community, especially for modeling.

General Comments:

One general suggestion would be to add more references to the Introduction. While many of the statements are known, it would still be helpful to have additional citations. This would also strengthen the background information. For example, sources could be added for the aerosol produced from wave breaking.

The following references were added:

Clarke et al. (2013) (long-range transport of aerosols) (Line 34).

de Leeuw et al., (2011) (wave-breaking source of sea spray aerosol) (Line 37).

This may be beyond the scope of this paper, but because there is a section on past data usage, there could be a couple sentences about future data usage as well. This could include the outlook for these measurements and how they could be used in models, etc.

The list of past use of the data is likely quite similar to future use. A sentence has been added stating that “Future use of the data is likely to be similar but could be expanded, for example, to halogen chemistry relating to sea spray aerosol” (lines 927 - 929).

Specific Comments:

In Figure 1, the legend seems unnecessary, since each cruise is labeled in the map as well.

Since there are so many colors involved and cruise titles, we decided to include both the legend and the labels on the map.

For Table 1, could the names be included in the table, instead of included as footnotes? It seems like each cruise has a footnote, so that could just be an additional column, or written under the acronym.

The current format allows for the website (when available) for each cruise to be listed. Fitting the full title of the cruise and the website would be difficult in the existing space.

Page 3, Line 75: I would add a sentence here similar to “Each cruise is presented briefly in the following paragraphs.” And then make “The Pacific Stratus...” the start of a new paragraph.

A sentence has been added stating that “Each cruise is briefly described in the following paragraphs” (Lines 82 – 83).

Figure 2 is interesting to see but may not be that useful. For example, panel c is not very clear and just looks like a lot of tubing. It is not clear what the tubing is connected to. Depending on the goal of this figure, it might be better to show a schematic instead. If it is not published elsewhere, it would also be helpful to have a general schematic of the inlet in this paper. It is relatively unique to the PMEL sampling platform and thus would be good to include, even in a supplement.

Figure 2 has been replaced with a schematic of the aerosol sampling inlet and a flow chart showing how the sample air was distributed from the inlet to the instrumentation.

In addition, a link has been added to full schematics for all of the inlet parts (<https://www.pmel.noaa.gov/acg/gallery/aerosol-sampling-inlet-schematics>).

Page 13, Line 321: Because it is stated that the limits varied based on the cruises, it would be helpful to have a range instead of one specific number. No number is listed for the relative wind direction, even though there are values listed for the other two limits.

The sentence has been changed to “...and the relative wind direction was forward of the ship’s beam ($\pm 90^\circ$)” (Line 3330).

Table 2: Similar comment as for Table 1 – could the names of the instruments be included in the table instead of as a long list in the footnotes?

They could but the thought was to make the measurement tables as similar as possible and also as concise as possible. The footnotes are primarily for readers not familiar with common aerosol instrumentation.

Table 3: It would be easier to read if there was a separate column for particle size ranges. The substrate types could be added as well. Also, some of the rows have the instrument listed (i.e., IC) while others do not (i.e., the last row, which has AMS measurements). It might be helpful to have sub-headers, such as “Inorganic ions”, “OC and EC”, “Aerosol Mass”, etc. since each of those encompass multiple rows. If it is not too variable, it might also be good to add the time resolution for some of these so that it is easy information to access.

A column for particle size range was added.

We did not add substrate types to the table because they are already listed in the text of the Methods section.

We added sub-headers for the different chemical species.

We added “AMS” to the instrument type for non-refractory species -- thank you – that was an oversight.

Finally, we did not add time resolution because it was too variable over the different cruises.

Page 24, Line 588: Can you list the trace elements measured with XRF? Some are listed in the following dust discussion, but there are likely more.

Only concentrations of Al, Si, Ca, Fe, and Ti are included in the NCEI archive so we did not mention other trace elements in the text. An explanation was added as follows “Concentrations of Al, Si, Ca, Fe, and Ti are included in the NCEI archive as these were used to calculate dust. Other trace elements were measured but were often below detection limit so they were not reported” (Lines 603 – 604).

Table 4: Can the particle size be a separate column?

A column for particle size range was added along with sub-headers.

Table 5: Similar suggestion as Table 3 – subheaders or another column would be helpful for the parameters, since they are repeated. Also, DMS is the only species measured in both the atmosphere and the seawater, so this could be two different tables.

Sub-headers were added and a separate seawater table was added.

Page 37, Line 922: The phrasing of point #8 is a little odd. Is the “not” supposed to be there?

The sentence has been re-written as follows “A variable and often large fraction of submicron aerosol mass in the marine boundary layer, both remote and continentally influenced, is composed of species other than non-sea salt sulfate” (Lines 910 - 912).

Page 38, Line 927: In point #8, it is written as “non-sea salt sulfate” and in point #9, it is written as nss SO_4^- . These should be consistent.

Both are now “nss SO_4^- .”

Reviewer 2

Quinn et al. present a comprehensive, publicly available dataset of marine aerosol properties collected from a series of research cruises conducted in the period 1991 to 2020 across all major ocean basins. The goal of the authors is to make the dataset more widely available to the research community and, given the richness of the dataset, this is certainly a worthy contribution to the literature. The summary of how the data have been used is a nice addition and the details of how the data can be accessed are sufficient. Given this, I suggest publication based on minor revisions.

Overarching minor comments

While the introduction does a good job in motivating the publication of this dataset in its entirety from a science perspective, I think that some further discussion of the need for this dataset and its publication now could be considered by the authors. As written, the introduction implies a lack of comprehensive in situ data (which is certainly the case), but this implication could be strengthened to state the value of this dataset over existing datasets (e.g., consistency, global coverage, etc.) and how this will likely help model or satellite validation amongst other things. In the same vein, the authors could also consider framing the dataset amongst current scientific priorities (e.g., linking ocean biology to climate, uncertainties in aerosol radiative forcing, etc.).

The following text has been added to the Introduction: “The data set is unique in that standardized methods and sampling protocols were employed including particle size cuts at a common relative humidity upstream of instrumentation and particle collection devices. This approach eliminates biases in the data and allows for direct comparison of measured regional properties between cruises. The global nature of the data set makes it well-posed to address current scientific priorities including reducing uncertainties in aerosol radiative forcing and links between ocean biology climate. The details provided here describing the measurements in depth are intended to increase the usability of the data” (Lines 56 – 62).

While the methods section provides substantial details on aerosol sampling, contamination control, humidity conditioning, etc., I do miss a little more engineering detail. If I want to replicate the design of the aerosol sampling mast, for example (and I may well want to do this to provide continuity with these measurements), I would like to either see exact inlet geometry details or a very clear link to where they can be found.

Based on comments from both reviewers, we have replaced Figure 2 with a schematic of the aerosol sampling inlet and a flow chart showing how the sample air was distributed from the inlet to the instrumentation.

In addition, a link has been added to full schematics for all of the inlet parts (<https://www.pmel.noaa.gov/acg/gallery/aerosol-sampling-inlet-schematics>).

While Figure 1 effectively demonstrates the global coverage of the dataset, in my view, the inclusion of individual cruise labels and a detailed legend makes the figure visually cluttered

without adding interpretable information. As such, I would be inclined to simplify the figure (for example, by grouping cruises or removing individual labels to improve clarity).

Since there are so many colors involved and cruise titles, we decided to include both the legend and the labels on the map.

Figure 2 provides photographs of the sampling setup as a means of providing context. However, it provides limited insight into the sampling design or flow configuration (see my second comment above). I would much prefer to see a schematic illustrating the inlet geometry, airflow paths, and key components (e.g., RH conditioning, subsampling lines), since this would be much more informative for readers seeking to understand or replicate the system.

See comments above.

Specific comments

Line 14 - I would probably rephrase to "The result is the most comprehensive publicly available database of marine aerosol properties to date."

Done.

Line 15 - Should be "gas-phase"

Changed.

Line 187 - should read 2002 I think

Corrected.

Throughout - be consistent with how charges are written (e.g. SO_4^- , SO_4 , SO_4^{2-})

All instances of sulfate have been changed to SO_4^- .