We thank both reviewers for their careful and constructive comments. We appreciate the positive assessment of the manuscript and the recognition of the improvements made compared with the previous submission. In response to the reviewer comments, we have clarified the treatment of instrumental uncertainty and intercampaign comparability, expanded the discussion of CCN–aerosol relationships and their physical interpretation, strengthened the discussion of uncertainty and limitations, and added additional contextualization regarding marine aerosol processes, ENSO variability, and implications for RRAP-related atmospheric research. We have also revised the introduction and conclusions for improved clarity and added several new analyses and comparisons suggested by the reviewers.

Review Sulo et al. “Coral emissions increase aerosol and cloud condensation nuclei over the Great Barrier Reef.”

The authors analyze multi-year in-situ measurements over the Great Barrier Reef, starting from seasonal differences in cloud condensation nuclei (CCN) concentrations and linking them to variations in aerosol size distributions. Using gradient boosting regression modelling, the authors estimate the contribution of Aitken-mode particles to CCN. I have reviewed this manuscript in another journal, and I recognized that this version has made substantial improvements compared to the previous submission. I recommend it for publication after minor revision.

Main comments:

(1) The authors link high Aitken-mode fractions and air back trajectories to infer that the aerosol contribution is locally reef-derived new particle formation. But the particle number size distribution did not show any NPF events. The clear bimodal distribution shows the aerosol went through cloud processing and aging, which means the aerosol is from long-range transportation, not a local source. Could the author elaborate this?

We have elaborated on the links between high Aitken-mode fractions and reef exposure in the text by adding the following text in Line 484

It is important to note that this enrichment is clearly not the dominant process, but rather occurs in the background. The process is likely similar to the silent NPF described in Kulmala et al. (2022), in which it is mostly unobservable in surface plots. This is one of the

key reasons why the effect can only be inferred through statistical modeling and back trajectory analysis. Direct confirmation of this requires long-term dedicated aerosol measurements that we currently do not have.

(2) The unusually high concentrations only observed in 2016 remain unexplained; the conclusion that springtime CCN enhancement is driven by local reef-derived NPF appears insufficiently justified. Why will ENSO affect the variability? I am still missing the logic chain between ENSO and CCN variability.

We have added additional text to Line 227 discussing uncertainty to explicitly address the unusually high 2016 concentrations:
The unusually high concentrations observed in 2016 may be linked to the exceptionally strong El Niño conditions during that year, which was the only clear El Niño period in the dataset. ENSO can influence CCN concentrations through changes in sea surface temperature, marine biological activity, DMS emissions, sea spray production, and boundary layer dynamics, as well as through altered transport, convection, and wet scavenging. These processes affect both aerosol precursor availability and the growth and survival of particles into the CCN size range. However, the available data do not allow a direct attribution, and the cause of the elevated 2016 concentrations remains uncertain.

We have also made the logic chain between ENSO and CCN variability more explicit by modifying the conclusions in Line 493 to "We can hypothesize that long-term changes in climate and large-scale weather patterns such as ENSO and the Southern Oscillation affect CCN concentrations primarily through changes in aerosol sources, sinks, and transport pathways. Variations in sea surface temperature influence marine biological activity, DMS emissions, and sea spray production, all of which alter the availability of aerosol precursors and primary particles. At the same time, ENSO-driven changes in boundary layer height, convection, precipitation, and large-scale circulation modify vertical mixing, wet scavenging, and the transport of aerosols and precursor gases. Together, these processes influence both the production of new particles and the survival and growth of existing particles into the CCN size range."

(3) Abstract, the fonts of some text are different from the other

We have double-checked the text, including the abstract, for consistent fonts.

Review of Sulo et al. – *Coral reef exposure increases aerosol and cloud condensation nuclei over the Great Barrier Reef*

This manuscript presents an analysis of multiple atmospheric measurement datasets collected over the Great Barrier Reef (GBR) between 2016 and 2023. Overall, this is a valuable contribution for several reasons. First, the Southern Hemisphere remains significantly under-sampled compared to the Northern Hemisphere, limiting our understanding of background aerosol concentrations.

More importantly, the role of marine emissions and marine ecosystems in shaping atmospheric composition remains one of the largest uncertainties in climate models. This is especially relevant in the Southern Hemisphere, where anthropogenic influences are generally lower than in the Northern Hemisphere. Studies such as this are therefore essential for improving our understanding of aerosol–cloud interactions in relatively pristine environments.

Additionally, the relative isolation of the GBR from major continental sources provides a unique opportunity to investigate the contribution of primary marine sources and marine biochemistry to marine aerosols.

General Comments

The manuscript compares CCN concentrations and particle size distributions across six field campaigns. While this comparative approach is useful, I have several general comments regarding the experimental design and data interpretation, followed by more specific comments on the manuscript.

1. **Instrument consistency and uncertainty**

The study combines datasets obtained using a range of instruments across different campaigns. This is a great approach to improve both the spatial and temporal significance of observations. However, given that a substantial part of this study relies on comparing measurements across campaigns, it is essential that the uncertainties amongst all instruments should be carefully addressed. The operation and calibration procedures should also be explained or referenced if already explained elsewhere. Most of these instruments have an acceptable variation of 20% amongst the instruments (CAIS-ECAC).

Without this, it is difficult to assess whether observed differences between campaigns are physically meaningful or within instrumental uncertainty.

We thank the reviewer for highlighting the importance of instrument intercomparability and calibration uncertainty when combining datasets from multiple campaigns and years. We

agree with the reviewer that it is important to address the uncertainty in the aerosol measurements, particularly given the presence of multiple measurement campaigns and different instruments. The earlier campaigns also do not have as comprehensive metadate and calibration documentation available. While the absolute intercampaign comparability is therefore a subject of some uncertainty, we note that the observed variability in concentrations substantially exceed even a conservative estimation of typical measurement uncertainty. Even assuming a 50% uncertainty in concentration, the variability in aerosol concentration is up to an order of magnitude and therefore considerably larger. We therefore interpret the major observed air-mass-dependent and temporal patterns as physically meaningful rather than dominated by measurement artefacts, while treating smaller intercampaign differences and sub-10 nm variability more cautiously. To clarify this, we have added the following to the uncertainty of analysis subchapter (Line 235):

Additionally, the synthesis of multiple campaigns conducted over several years introduces uncertainty associated with differences in instrumentation, calibration procedures, CPC detection efficiency, diffusional losses, and DMPS inversion methods. Metadata and calibration records were not equally comprehensive for all historical campaigns, particularly the earlier datasets, increasing uncertainty in absolute intercampaign comparability. Previous intercomparison studies suggest that well-calibrated mobility particle spectrometers generally agree within approximately 10–20% in the 20–200 nm size range, while substantially larger uncertainties may occur in the sub-10 nm size range because of low charging efficiency, diffusional losses, and counting statistics uncertainties (Kangasluoma et al., 2020; Wiedensohler et al., 2018). Nevertheless, the observed variability in particle concentrations within individual campaigns commonly exceeded a factor of several and was distributed across both Aitken and accumulation modes, suggesting that the major observed patterns are unlikely to be dominated by measurement artefacts. Finally, a lack of reliable measurements in the nucleation mode range and a lack of sub-10 nm altogether make accounting for local sources more demanding.

1. **Heterogeneity of datasets and air mass variability**

The datasets originate from different time periods and locations, meaning they are influenced by different meteorological conditions and air mass histories.

It may be beneficial to:

- Group measurements based on air mass origin or meteorological conditions, rather than campaign alone

- Identify air mass analogues, like the approach of Petit et al. (2021)

This would help disentangle the effects of source regions from campaign-to-campaign variability and strengthen the interpretation.

In addition, given that this study is in some way to provide information on background aerosol concentration for the RRAP program and to assess how the weather (radiation, long range transported airmasses) impact aerosol concentrations this would be relevant.

We recognize the importance of both air mass histories and the meteorological conditions in our analysis. We have chosen to present data grouped by campaign in order to avoid the reader inferring annual or seasonal changes that could be explained by different campaigns. In addition, grouping our data based on meteorological conditions resulted in an uneven division mainly separating campaigns conducted in spring and summer seasons. As we do not have enough data to discuss seasonality in our analysis, we think that it could be misleading to group our data by meteorological conditions. The gradient boosting analysis was conducted on all the data without any direct information that would bias the analysis based on the campaign, time, or spatial distribution. We think that this analysis showcases the effect of the metrology, suggesting that parameters such as sea temperature may have an impact on CCN concentrations. Additionally, our dataset is mainly affected by the trade winds, resulting in conditions in which almost all air masses originate from an open ocean (Fig. S2h) and their air mass back trajectories are quite similar (see Fig. AR1). Hence, instead of focusing on air mass origins, we used air mass history (reef fraction) to discuss their impact on CCN concentration (Fig 6). Although this analysis is presented more as a case study in our manuscript, it contains a major fraction of our data (89.2%). It is worth noting that the relationship between particles and long-range transported air masses was discussed previously by (Horchler et al., 2025). We clarified this point in our introduction. Lastly, identifying air mass analogues, while interesting to look at to determine clustered air mass origins, is beyond the scope of this manuscript as we focus our analysis on the local sources at the GBR.

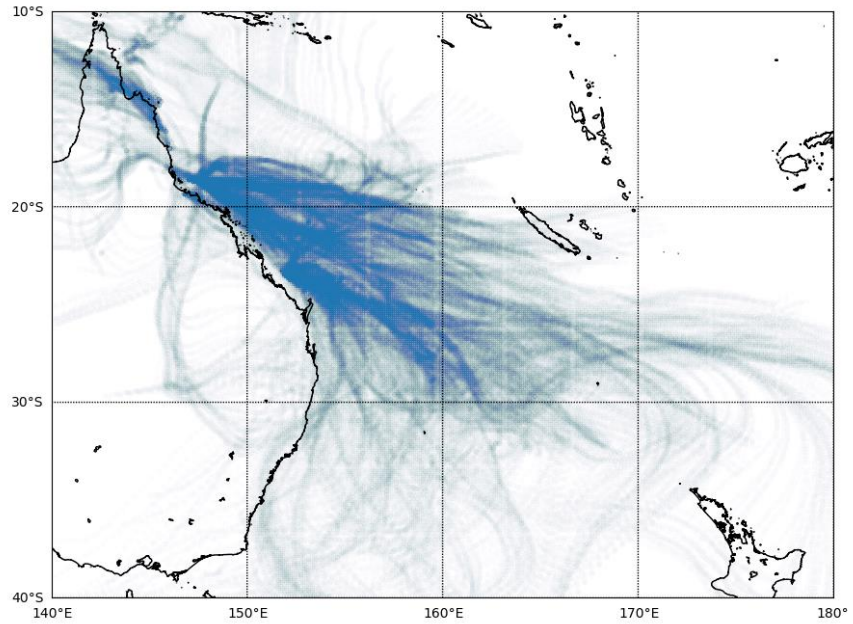

Figure AR1: 72-hours back trajectories calculated for all data used in the manuscript. Back trajectories were plotted in blue with high transparency, hence only overlapping points are clearly visible.

1. **Quantitative relationship between aerosol modes and CCN**

One of the stated objectives is to understand how aerosol properties influence CCN concentrations. While the manuscript presents a detailed statistical framework, the quantitative relationship between accumulation mode particles and CCN is not clearly expressed.

Specifically:

- How much of the variability in CCN can be explained by the accumulation mode alone? Can you provide a parametrization? Does this change depending on open ocean vs local airmasses?
- What fraction of the remaining variability is explained by Aitken mode particles or other factors?

Providing a more explicit parameterization or quantitative breakdown would significantly strengthen the conclusions.

We agree with the reviewer that providing a parametrization would be useful for comparison and modelling. We have added a simple power law parametrization to determine how much variation in the CCN concentration accumulation mode concentration explains. We have also added a comparison between clean marine airmass

subset and the rest of the data. This adds robustness to the analysis. We have added the following figure and text into the manuscript (Line 421):

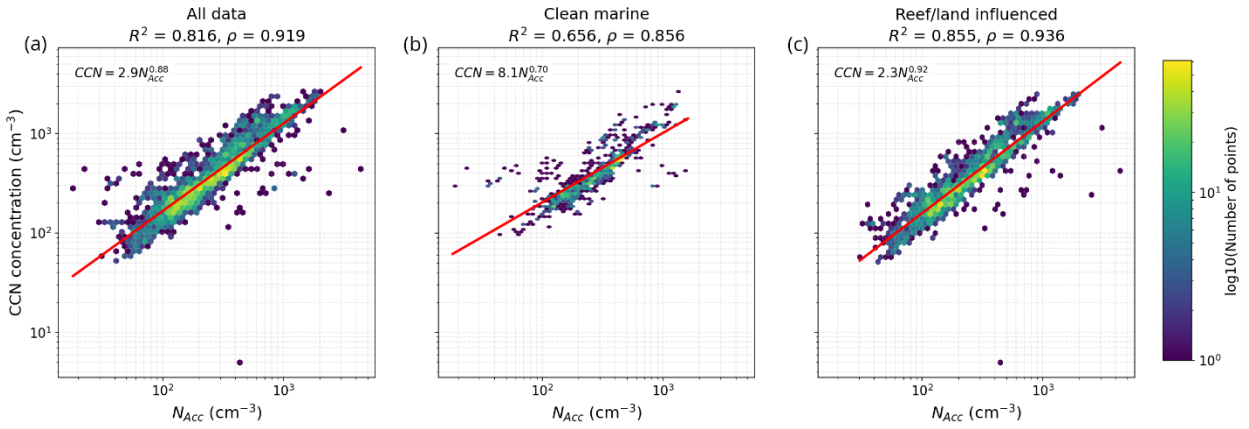

Figure 5: An ordinary least squares regression analysis fitted to log-log accumulation mode (NACC) and CCN concentration data for all the data (a), clean marine data (b), and reef/land influenced data.

We additionally fitted a simple power-law parametrization relating CCN concentration to accumulation mode concentration (N_{ACC}):

$$\log_{10}(CCN) = a \log_{10}(N_{Acc}) + b$$

,which corresponds to

$$CCN = 10^{b} N_{Acc}^{a}$$

The resulting parametrizations are summarized in Figure 5. Fits were evaluated for the full dataset as well as two subsets representing clean marine conditions (reef fraction < 0.1 and land fraction < 0.1) and reef- and/or land-influenced conditions. While the parametrization is not intended as a predictive model, it provides a useful framework for comparing how much CCN variance can be explained by accumulation mode concentrations alone under different air mass regimes.

The CCN–accumulation mode relationship weakened under clean marine conditions (R^2=0.656), suggesting that additional factors beyond accumulation mode abundance, such as aerosol composition, growth state, or recently formed particles, exert a larger relative influence on CCN variability in pristine marine air masses. This interpretation is consistent with the counterfactual gradient-boosting analysis, which indicated a modest but non-negligible contribution of Aitken-mode particles to CCN concentrations.

1. **Conclusions and future perspectives**

The conclusions would benefit from a short section outlining:

Implications for climate modeling (how do the relationships between CCN and Accumulation mode aerosols compare with previous studies?). Comparison of these measurements with these global studies would be immensely valuable.

- Andrews, E., Zabala, I., Carrillo-Cardenas, G. *et al*. Harmonized aerosol size distribution, cloud condensation nuclei, chemistry and optical properties at 10 sites. *Sci Data* **12**, 937 (2025). https://doi.org/10.1038/s41597-025-04931-y4
- Schmale, J. *et al*. Collocated observations of cloud condensation nuclei, particle size distributions, and chemical composition. *Sci. Data* **4**, https://doi.org/10.1038/sdata.2017.3 (2017).

Recommendations for future measurements (e.g., long-term monitoring, chemical composition)

We appreciate the reviewer's comment and agree that a comparison strengthens the argument. Comparisons between previous studies are complicated by different formulations for regression and variable transformations. However, we have added a short paragraph doing a qualitative comparison (Line 503):

Previous multi-site observational studies have demonstrated strong relationships between CCN concentrations and aerosol number concentrations across a range of environments (Andrews et al., 2025; Schmale et al., 2017), and our results agree well with these observations. However, direct quantitative comparison of fitted coefficients between studies is complicated by differences in regression formulation, supersaturation conditions, and variable transformations. Within the GBR dataset itself, the clean marine subset exhibited both a weaker power-law dependence and lower explained variance than reef- and/or land-influenced air masses. This suggests that under very clean marine conditions, accumulation-mode number concentration alone becomes a less complete parametrization of CCN variability, likely because aerosol composition, growth state, activation efficiency, and recently formed particles exert a proportionally larger influence. Overall, accumulation mode parametrizations work reasonably well overall, but clean marine environments may require additional treatment of growth processes and aerosol composition.

Specific Comments

Introduction

- The structure of the introduction could be improved for clarity. Some sections (e.g., around line 50) appear out of place within the current paragraph.
    - We recognize the lack of logical flow in the paragraph the reviewer mentions. We have slightly restructured the introduction to make it flow more logically

      Once we have accepted changes, should paste it here.
- The objectives of the study should be clearly stated at the end of the introduction.
    - We have added an explicity objective statement at the beginning of the last paragraph in the introduction (Line 71):
      The objectives of this study are to (1) characterize spatiotemporal aerosol variability over the GBR, (2) quantify the relationship between aerosol populations and CCN concentrations, and (3) investigate the influence of cloud processing and local aerosol sources on lower tropospheric aerosol dynamics over the reef environment.
- It would also be helpful to explicitly state that this work represents a reanalysis/synthesis of multiple previous campaigns.

We clarified this in line 74:

To address these objectives we characterize the spatiotemporal variation of aerosol concentrations over the GBR and quantify the drivers behind CCN concentrations using a synthesis of multiple previous campaigns conducted via mobile and stationary platforms over the span of eight years.

Methodology

- Several GBR-related studies are discussed in methodology but not in the introduction. Their main findings and gaps in the findings should be summarized earlier to provide context.

We added these studies to the introduction in line 81:

Previous RRAP-related atmospheric studies over the GBR have focused on targeted observations using airborne platforms such as drones (Eckert et al., 2023, 2024) and light aircraft (Hernandez-Jaramillo et al., 2024, 2025), as well as characterization of specific atmospheric properties including boundary layer height (Ryan et al., 2024), cloud vertical structure (Braga et al., 2025), continental influence (Horchler et al., 2025), BVOC fluxes within the reef lagoon (Deschaseaux et al., 2025), and spatial cloud distributions(Zhao et al., 2024).

- In Table 1, please include references to the original publications for each campaign.

Most of the data used in this work is unpublished. We added the reference in Table 1 to the original publication for the one dataset that was previously published.

CCN supersaturation

- Explain the limitations of using a single supersaturation, and also of such a high value **0.5%** ?
- Under what atmospheric conditions is this supersaturation expected over the GBR?
- Are particles realistically transported to altitudes where such supersaturation occurs? What bias can be implied from using such high SS.

We agree that these sources of bias are important to address and have added the following into the "Uncertainty of analysis" subchapter (Line 248):
Lastly, CCN concentrations in the dataset were measured at a single supersaturation of 0.5%. This limits our ability to fully characterize the CCN activation spectrum and the sensitivity of aerosol populations to changing supersaturation conditions. Different aerosol populations may exhibit different activation behaviour at lower supersaturations due to differences in size distribution, hygroscopicity, and mixing state. Furthermore, the typical supersaturation level over the GBR is likely variable and often lower than 0.5% (Horchler et al., 2025). Consequently, the measurements may overestimate CCN concentrations and activation ratios while underestimating critical activation diameter. The relatively high supersaturation used in this study also increases sensitivity to smaller Aitken-mode particles, potentially enhancing the apparent contribution of recently formed particles to CCN concentrations compared with lower-supersaturation marine cloud conditions. Aerosol particles over the GBR are expected to be transported into shallow marine cloud layers through boundary-layer mixing and convective uplift (Hernandez et al, 2024), making supersaturations approaching 0.5% physically plausible under clean marine conditions with low aerosol loading and low condensation sink, where reduced competition for water vapour allows higher peak cloud supersaturations to develop (Seinfeld and Pandis, 2016). However, reef- or continentally influenced air masses with elevated aerosol concentrations likely experience lower cloud supersaturations. Consequently, the 0.5% supersaturation used in this study likely represents an upper-range activation scenario rather than an exact representation of cloud supersaturation over the GBR.

Instrument uncertainties

As mentioned in the general comments, multiple instruments (SMPS, APS) are used for size distribution measurements. Please include typical uncertainties for each instrument and a brief discussion of inter-instrument comparability

In the manuscript a discussion is already provided for absorption instruments; a comparable statement should be included for particle sizing instruments.

We have addressed this above, see: **Instrument consistency and uncertainty**

Ship measurements

- How were pollution events (e.g., ship exhaust) filtered? What % of data was removed?

To clarify, we moved the description of methods used to filter pollution events to the calculation section. We also added information of fraction of the data removed due to pollution (Line 163):

The pollution flag was calculated using BC concentration to determine episodes when ambient air was contaminated by local pollution sources such as the ship plume or diesel engine sources on Heron Island. The RV Investigator uses its own algorithm for detecting when the ship plume is affecting its measurements (Humphries et al., 2019). For shipborne RRAP campaigns, we flagged data points during which the winds originated from the aft sector (90° – 270° relative to the ship's heading) and the black carbon concentration was above 30 ng/m3. For the Heron Island campaign, the limit for black carbon was increased to 50 ng/m3, representing elevated background concentrations due to co-located infrastructure at the island-based sampling site. The specific limits were selected to account for outliers, that is values larger than the limits are larger than the 95th quantile in the datasets. The pollution-flagged data accounted for 6.7% of our dataset.

Mixing state

- Page 6, line 155: Is there any estimate of **internal vs. external mixing** based on the size distribution data (number of modes etc)?

As far as we can see, page 6 does not contain any discussion of the mixing state. While describing calculations of critical diameter (page 5, line 129), we mention that the assumption of a fully internal mixture of aerosol particles is likely broken as we expect more complex mixing state in ambient aerosol data. The clear separation of the Aitken and accumulation mode visible for most of our data (Hoppel minimum calculated for 92% of the data) suggests that the aerosol particles are not completely internally mixed. Although estimating how much internally mixed are aerosol particles could help estimating the

uncertainties of our calculation, we think that the robust estimation of the aerosol mixing state is beyond the scope of this paper.

Results

Kappa values : The reported hygroscopicity (κ) values should be compared to large-scale CCN datasets (e.g., long-term measurements such as those reported by Schmale, Andrews et al.). This would provide context for whether the observed values are typical or unusual.

We agree with the reviewer that a comparison to large-scale datasets is helpful to the reader. We have added a sentence to address this to line 305:
Overall, the observed kappa values fall within the broad range reported in previous long-term CCN studies and marine aerosol observations, with median values comparable to moderately hygroscopic marine aerosol populations reported in the literature (Andrews et al., 2025; Schmale et al., 2017).

Figure 1: Does it make sense to directly compare all campaigns in this way? Ship-based measurements (open ocean) vs. land-based (reef/cay) measurements may not be directly comparable. Are there observable gradients between coastal, reef, and open-ocean environments?

We have specifically opted to show each campaign separately in order to avoid confounding possible spatial differences and/or methodological uncertainties with temporal variability in Figure 1. While we agree that studying gradients between coastal, reef and open-ocean environments is valuable, the datasets that we have are spatially too diverse to systematically study gradients between reef and open-ocean environments.

Interpretation of aerosol modes

Line 272: The statement regarding accumulation mode particles should be rephrased to reflect that this is consistent with previous studies.

We have added additional emphasis that this is indeed consistent with previous studies (Line 380):
The analysis shows that accumulation mode particle number concentration is the strongest predictor of CCN concentration, with higher accumulation mode concentration leading to higher CCN concentration (Fig. S9 a,b), which is consistent with previous studies (Fossum et al., 2020; Kawana et al., 2022; Seinfeld and Pandis, 2016).

I maybe did not fully appreciate the method used in this section but the role of sub-100 nm particles in CCN formation requires clarification. Is their contribution evaluated

independently of accumulation mode particles? Could the observed relationship simply reflect correlation between modes?

The gradient boosting model, as a tree-based ensemble method, considers the predictor importance in the presence of all other model inputs, and the feature importance analysis therefore represents added value, not covariance with other model inputs. We have added additional explanation to the manuscript to assist the reader in appreciating the strengths of the method (Line 384):
Importantly, the gradient boosting model evaluates predictor importance conditionally in the presence of all other variables included in the model. Therefore, the identified importance of Aitken mode concentration does not simply reflect covariance with accumulation mode concentration but indicates that Aitken mode particles provide additional predictive information for CCN concentrations beyond that already explained by accumulation mode particles alone.

In relation to my general comments, Is it possible to quantify CCN variability explained by accumulation mode and then analyze the residual variability in relation to Aitken mode particles?

We have addressed this in the general comments.

Statistical significance

Page 13, line 290: Differences between campaigns appear small and may fall within instrumental uncertainty. Have you performed some significant tests on the different presented in the different figures (e.g. Fig 2)

We are unsure what this comment means as line 290 on page 13 discusses results from the counterfactual modelling analysis. We did statistical testing between campaigns for various parameters and we observed both statistical differences and similarities in parameter distributions. It is strongly dependent on the parameter tested, and there is no campaign that could be interpreted as an outlier based on the aerosol or meteorological properties. The variation in most aerosol parameters is at least an order of magnitude, hence they exceed the possible instrumental uncertainty.

Nucleation and Aitken mode

It was stated that the nucleation mode measurements were not available. Based on previous studies can you estimate the contribution from new particle formation events and under what conditions they are likely to occur.

Based on previous studies such as Modini et al. (2009) and Vaattovaara et al. (2014), new particle formation events over the GBR are most likely to occur under clean marine conditions characterized by active photochemistry, low condensation sink, and marine air masses. It is not possible to robustly quantify the contribution of these events to total particle number concentration from the present dataset. However, Modini et al. (2009) detected NPF in clean marine air masses, which occurred approximately 65% of the time during their measurements. Their observations were conducted at Agnes Water, a coastal location, and therefore are not perfectly representative of the open reef environment. Nevertheless, the available observations suggest that low-intensity NPF is likely a relatively common feature of clean marine conditions over the GBR. We have also added the following to line 399:
Previous studies suggest that low-intensity new particle formation is likely a relatively common feature of clean marine air masses over the GBR under conditions of active photochemistry and low condensation sink (Modini et al., 2009; Vaattovaara et al., 2014).

Line 304: Do you suspect that the Aitken mode primarily due to primary emissions, or Secondary formation processes? Can these processes be distinquished?

We suspect that the Aitken mode observed over the GBR is likely dominated by secondary aerosol formation and subsequent particle growth processes rather than direct local primary emissions. In particular, marine biogenic vapours, transported secondary aerosol, and aged marine air masses likely contribute substantially to the observed Aitken mode concentrations. Long-range transport may include both primary and secondary aerosol, distinguishing between these aerosol particles is not possible with the present dataset because detailed chemical composition and source-resolved measurements were not available. However, the relatively low local combustion influence over much of the reef environment suggests that local primary emissions are unlikely to be the dominant source of Aitken-mode particles.

Discussion and conclusions

Line 319 The comparison with Dall'Osto et al. is interesting. Are Southern Ocean and North Atlantic marine environments directly comparable? Given the undersampling of the Southern Hemisphere, this point could be expanded.

We recognize that the GBR and the North Atlantic marine environment are not direct analogues, largely due to the northern hemisphere being more influenced by anthropogenic emissions. However, both environments are comparably clean coastal environments within their own context, and the comparison with Mace Head is a useful

comparison while requiring to be approached with some caution. We have expanded this in the manuscript (Line 468):

While the North Atlantic and GBR are not directly equivalent marine environments, the comparison with Mace Head provides useful context for clean coastal aerosol conditions. The comparison to Southern Ocean represents a substantially more pristine Southern Hemisphere marine environment showing that aerosols in the GBR are higher than that baseline.

In the conclusion it would also be useful to state what the implications of this work are with respect to the Reef restoration and adaptation program ?

We have added a paragraph at the end of the conclusions to address the implications of this work for RRAP (Line 528):

Our results have important implications for the RRAP Cooling and Shading subprogram. The observed sensitivity of CCN concentrations to air-mass conditions, and the complex aerosol dynamics having an impact specifically in clean marine air masses suggests the effectiveness of cooling and shading intervention over the GBR is likely notably variable in space and time. Consequently, robust characterization of baseline aerosol-cloud interactions and long-term atmospheric monitoring are essential for evaluating the potential effectiveness and environmental impacts of future solar radiation management interventions over the reef.

Summary

This is a valuable study addressing an important gap in Southern Hemisphere aerosol observations. However, the manuscript would benefit from clearer treatment of instrument uncertainties. A different approach to handing the different datasets, comparing them based on meteorological and airmass signatures rather than from different periods.