We thank the reviewers for their helpful comments and their time. Please find our replies below in grey italics.

"Measurement report: New particle formation and aerosol properties at a newly founded atmospheric observatory at the Finnish Baltic Sea coast" by Peltola, et al.

This study presents data from a new aerosol measurement station on the Finnish Baltic Sea coast and is particularly focused on new particle formation events and the factors related to them. The dataset is large, with many variables measured, and it was well analyzed and put into context with the other Finnish measurement site at Hyytiälä. The writing and explanations could be improved, but overall the paper is good and I recommend it to be accepted for publication as a measurement report in ACP, after addressing the specific comments below.

We thank the reviewer for the valuable comments.

General comments:

1. The introduction could have more background on what NPF is and what the known factors are that lead to NPF. The introduction now is a bit too heavily focused on why coastal research is important – this is good, but introductions are also important for explaining concepts and background knowledge needed to understand the study.

We have added a paragraph on the importance of studying aerosols and new particle formation in the beginning of the introduction. It is following:

Aerosol particles are an essential part of the atmosphere, known not only for their adverse health effects, but also for their uncertain direct and indirect climate effects (Masson-Delmotte et al., 2021). Aerosol size distribution and chemical composition are essential, since they define the number of aerosols that can act as cloud condensation nuclei (CCN) under different conditions. Thus, they influence the radiative properties of clouds and further on, the radiative balance of the Earth. The majority of global CCN are produced by new particle formation (NPF) in the atmosphere (Gordon et al., 2017). In NPF, aerosols are formed in the atmosphere through gas-to-particle conversion. These gases have various sources, ranging from vegetation to human activities, and typically they need to go through chemical reactions in the atmosphere before their volatility becomes low enough for them to contribute to NPF. One important factor governing aerosol formation is the pre-existing particle population that acts as a sink for both condensing vapours and the small freshly formed particles. The source of condensing vapours thus needs to be large enough for particles to survive and grow to climate relevant size ranges.

2. The differences between "marine" vs. "continental" air masses are a big point of the paper. However, your "marine" sector comes from the south which is immediately marine but preceeded by the entirety of continental Europe. Does this not influence the air? And the "continental" sector is from the north, which is immediately land, but

further north is all sea and the Arctic, which I would think also influences the conditions of the air mass. Your coast is different than say, the coast of California where west is truly marine and east is truly continental. Although NPF is a more local phenomen, I wonder if the longer history of the air masses matter. I think it would be good to this address this further.

This is a good point. The wording was chosen since the focus of the paper is largely on very local phenomena occurring in the near vicinity of the station. It is however true that the longer history influences the air mass properties, including condensation sink and concentrations of more long-lived chemical species. See the reply to the next comment for text that we added that also addresses this comment.

3. Which wind direction provides cleaner air needs to be more clearly and consistently explained. What I understand is a) that NPF is more likely in cleaner (less aerosol) conditions, and b) the marine sector is south/southeast and the continental sector is north/northwest/northeast. However – Line 126 says that the marine sector is less polluted than the continental sector, but then Line 158-162 (and again later) says that most NPFE days were from north/northwest wind direction (continental) because it is "clean compared to other directions", which is a contradiction to Line 126. I was left a bit confused throughout the results & discussion because it was not clear to me which direction is clean and which is polluted (especially because typically we think of continental as being more polluted than marine due to anthropogenic influences – why is your "continental" not like that?). It may help to be specific in each case about what "clean" or "polluted" refers to, i.e., refer to specific species (less CO in marine than continental, or more particles >25nm in marine than continental).

This is a fair point. The paper draft was originally very focused on the local intermediate ion formation and thus the most recent air mass history. We defined the wind sectors as "marine" and "continental", based on the most recent airmass history. However, it is important to note that when studying the airmass history for a day or more, the air in our "marine" wind sector may have spent a significant time over land. Thus, the terminology refers only to the most recent airmass history, and this needs to be remembered when interpreting the results.

To clear this out, we replaced the sentence on line 126 with text "Analysing trace gas data (see Appendix B) showed that carbon monoxide and sulphur dioxide had lower concentrations in the marine sector while ozone and nitrogen oxides had higher concentrations in marine air. On the other hand, the marine sector had higher concentrations of accumulation and coarse mode particles (see Results section). Even though in the marine sector the air has most recently passed over the sea, over the course of the previous days it has likely crossed over land in continental Europe and been influenced by anthropogenic sources then. The air in the continental sector, on the other hand, has recently crossed over land, but in some cases this interaction has been brief. If the air comes from the northwestern direction, it has previously travelled over the North Sea and the free tropospheric air in these air masses can be very

clean. Neither of the sectors is thus completely 'marine' or 'continental' and the names were chosen to reflect only the most recent air mass history."

4. You use Hyytiälä as a comparison for NPFE, but why don't you compare other data to that site, like ions and larger aerosol concentrations and trends?

Originally, we considered this but opted not to for a few reasons. Firstly, we wanted to keep a clear focus on Tvärminne and not include too much data from the Hyytiälä station (which has been the focus of numerous studies in the past). Secondly, as we had not cross-calibrated the instruments at the two sites, we could run the risk of overinterpreting instrumental offsets as continental vs marine influences.

5. Can you compare your results to other coastal or marine sites, in addition to Hyytiälä?

We added some comparison to results published previously from Utö, located in the archipelago 100 km west of Tvärminne (see reply to Dr Laakso). More in depth spatial comparison will be done in the future.

6. Appendix B should come before Appendix A because it is mentioned first. Figures should always be in order of when they are referenced in the main text.

We have changed the order.

7. The language and sentence structure is very repetitive at times. Try to vary it more. For example, many (41) sentences start with "This.." (and 'this' should always be followed by a noun, otherwise it can be confusing). "This is in line with", "this is expected / as can be expected", "this explains"... are used quite a lot.

We understand how that might be annoying. We hope that the scientific message of the article is not lost because of this and hope that this could be addressed in the proof-reading phase if necessary.

Specific comments (line numbers):

15-19: The introduction starts rather abruptly and requires prior knowledge of CCN and NPF. I would recommend giving a very basic introduction to NPF and then explain why it is important for our atmosphere and climate, relating it to cloud formation, etc. Then, after the basics, you can go into the marine vs. continental topic.

We have added a paragraph on this at the beginning of the introduction (see reply to the other reviewer).

23: "chemical mechanisms" -> "chemical species"

We meant mechanisms as some of the species were already known to produce aerosols in some form. For clarity, we changed the text from "More advanced measurement techniques have also uncovered new chemical mechanisms that can form aerosols in marine environments including ..." to "More advanced measurement techniques have also uncovered

new chemical mechanisms that can form aerosols in marine environments. These chemical mechanisms include chemical compounds such as…"

29: add references after "open ocean" and "polar conditions"

Most of these references appeared already earlier, but we added references to O'Dowd et al., 2010, Brean et al., 2021, Zheng et al., 2021, and Peltola et al., 2022 for open ocean and Zheng et al., 2021, Baccarini et al., 2020 and 2021, Beck et al., 2021, and Schmale et al., 2021 for polar conditions.

41: "since aerosols can have a cooling effect on climate" -> Aerosols can have a cooling or warming effect on climate (direct radiative effects vs. indirect aerosol-cloud interaction effects), and the uncertainty in the overall direction of cooling/warming is one of the big reasons why aerosols are so important to study. You should therefore rephrase this.

True. We rephrased the end of the sentence as "since aerosols can have both cooling and warming effects on climate and these effects are highly uncertain".

42: What is CarbonSink+? Is it a model? If it's relevant to your paper, then you should explain it, otherwise remove it.

It is more of an approximate calculation of the climate effects that ecosystems can have when both carbon sink and aerosol formation potential are considered. It is included here, because it was one of the motivations to focus on local intermediate ion formation, which is discussed in the next paragraph. We added the following text after this line to clarify this: "CarbonSink+ uses relatively simple calculations to evaluate the full climatic impacts of an ecosystem. This includes not only estimating the carbon uptake but also taking into account albedo changes, CO_2 fertilisation, and aerosol induced diffuse radiation enhancement. The concept highlights the need to consider the aerosol forming potential of an ecosystem to be able to fully evaluate its climate impacts."

74: How high up are the wind measurements?

At 4.2 m above mean sea level. We removed sentence "Meteorological data, including wind, global radiation, and temperature were collected at the flux measurement island." and added text "Meteorological data were collected at the flux measurement island. Out of meteorological measurements we use wind data data measured at 4.2 m height with a METEK uSonic-3 Scientific as well as ambient temperature and relative humidity measured at 4.0 m height with Vaisala HMP155 at and total irradiance measured at 3 m height with Delta-T SPN1 sunshine pyranometer." to the end of Section 2.1.

82: How far from the sea/coast is the Hyytiälä station?

Approximately 150 km. We added text "and 150 km east of the nearest sea coast".

82: Reference Fig. 1 here.

Added.

Fig 1: The map scale needs to be bigger to be legible.

The map was made by combining two maps downloaded from European Union's Copernicus Land Monitoring Service. We are thus unable to change the font size of the scale, but we have cropped the image more to make the scale more legible.

84-85: Where were the DMPS and APS located (which trailer)?

They were in the trailer further inland. This was mentioned on line 91, but we edited the text now so that it reads in the beginning of this paragraph rather than the end. The beginning of the paragraph now has a sentence: "In addition to the NAIS data, we use gas and particle data measured in the container measured further inland. These data include…" and removed texts ", all located in the container further inland", and "All the trace gas instruments, the DMPS, and the APS were located in the container further inland." that appeared later in this paragraph.

90: "for the other instruments" -> which ones?

The other gas analysers (CO, NOx, and O3). We replaced 'instrument' with 'gas analysers' to clarify this.

98: "and that particle mode needs to grow in size" -> "and the growth of that mode".

Changed.

99-103: Move the sentence "The difference between Class I and Class II…" to before the sentence "Observing this requires…"

To us it makes more sense the way it is now. If we changed the order, it would not be clear what 'this' in 'Observing this' refers to.

105: Paragraph break before "For the event analysis…"

Done, although now that new paragraph is only two sentences.

106: "For the event analysis, we used NAIS size distribution data from both Tvärminne and Hyytiälä" -> do you mean that in order to determine NPFE at each site, you used NAIS data from each site? I would rephrase to: "To determine NPFEs at Tvärminne and Hyytiälä, we used the NAIS size distribution data (total particle concentration measured with the negative polarity) from each respective site."

Yes, this is what we meant, we changed the text according to the suggestion.

107: "where both stations had complete data" -> "where both stations simultaneously had complete data"

Done.

126: “the marine sector is less polluted than the continental sector” -> see general comment above.

Answered in the general comment.

138: please define “condensation sink” here.

We added text ‘Condensation sink represents the total surface area of the particle population that acts as a sink for condensing vapours.’ We also added the commonly used abbreviation for condensation sink, CS, here.

144: delete “located 230 km north-north-east from Tvärminne”

Done.

146: “On average, Tvärminne had 9.3% clear NPFE days …” -> What do you mean with “on average” here? Do you mean overall in the year, 9.3% of days had NPFE? Or overall in the whole dataset?

Replaced ‘On average’ with ‘In total’.

150: Rephrase the sentence “Although the average event frequences…” to “Although the average event frequences we report here are lower than, e.g., earlier Hyytiälä measurements by Nieminen et al. (2014), the spring and early autumn maxima were similarly observed.”

Done.

154: Move point (1) to the end and rephrase “classifying events manually can be subjective”

Done.

155-162: Rather confusing paragraph. In the sentence “During these clear regional NPFE days…” (158), which site are you referring to? Both of them? It is not clear then, why NPFE were observed so rarely on the same day at both sites… The sentence “This is also in line with previous results from Hyytiälä” also needs rephrasing -> “Similarly, previous results from Hyytiälä show that NPFE typically occur when air masses come from the north-northwest (280°-30°) (Nieminen et al, 2014).”

Good point, we changed text;

“An inspection of air mass back trajectories calculated with HYSPLIT (Stein et al., 2015; Rolph et al., 2017) for Class I and II events suggests that air mass history is likely to explain these differences. During these clear regional NPFE days, the air masses arrived primarily from north or north-west (Appendix Fig. B5) whereas on non-event days the air mass back trajectories could be from any direction. This is also in line with previous results from Hyytiälä since there events typically occur when the air masses come from the sector 280◦–30◦(Nieminen et al., 2014).”

to:

"An inspection of air mass back trajectories calculated with HYSPLIT (Stein et al., 2015; Rolph et al., 2017) for Class I and II events observed in Tvärminne suggests that air mass history is likely to explain these differences (Appendix Fig. B5). During the clear regional NPFE days, the air masses arrived to Tvärminne primarily from north or north-west whereas on non-event days the air mass back trajectories could be from any direction. Similarly, previous results from Hyytiälä show that NPFE typically occur when air masses come from the north-northwest(280◦–30◦) (Nieminen et al., 2014)"

166: "When comparing…" -> "When comparing the median ion concentrations of the two wind sectors, sub-2 nm ions had 39% and 2-2.3 nm ions had 22% higher concentration in continental air."

Done.

174: Why is there no diurnal pattern in marine air? Do you have any theories?

Yes, we added text to explain this: "This is reasonable as over the sea ionisation happens primarily by cosmic radiation which has no diurnal pattern. For example Komppula et al. (2007) have estimated that while in Hyytiälä cosmic radiation accounts for 30% of of ion production, in Utö, which is located in the outer archipelago, 100 km west of Tvärminne, cosmic radiation can account for 60–70% of ion production."

195-197: Why is the seasonal trend of sub-2nm ions different than the larger ions?

Sub-2 nm ions are driven by different factors than larger ions. See reply to the comment on Section 3.2.

198: Start with "Overall, …"

Done.

Section 3.2: Perhaps it would be good to provide some background on the basics of ion formation and the differences between sub-2nm and larger ions (how they are formed, the relation to NPF in general, etc), either in the introduction or in this section.

We added brief description of why these size ranges were chosen in the Methods section (line 134), since that is where the chosen size ranges were first introduced. "Sub-2 nm ions contain large molecular ions and clusters of molecular ions (Chen et al., 2016) and their concentrations are driven by factors such as pre-existing particle population and ionisation rate (Sulo et al., 2022). Concentrations of intermediate ions, on the other hand, depend on if there are enough condensable vapours to grow sub-2 nm particles to larger sizes before they are lost by coagulation. To be observed in the 7-25 nm size range, newly formed particles typically need several hours to grow."

205: This background info on condensation sink is great, but it should also (or only) be in the introduction.

We removed sentence 'Condensation sink is used to represent how fast condensible vapours are lost to the total surface area of particles' since this information is now already told at the end of Section 2.2.

206-207: Make a better/clearer connection between condensation sink and particle size distributions. (e.g., that total surface area of particles is estimated from particle size distributions assuming spherical particles)

We tried to clarify this, and the beginning of the paragraph now reads: "Since particle formation depends on the relative strength of sources and sinks, we first explore the general shape of the particle size distribution in the two wind sectors, as well as the effect of condensation sink. The size distribution can reveal us differences in how much new particles are formed and how far from the site this occurs. As condensation sink is dependent on the total surface area of the particles and the surface area is proportional to the square of particle diameter, size distribution data can also reveal information on the condensation sink."

213: Replace "thing" with "aspect". ("thing" is very colloquial and vague, and should not be in scientific papers, in my opinion)

Done.

214-215: Why is the NAIS known to show higher concentrations than the DMPS? Is there a physical reason or is it just instrument bias?

The paper by Kangasluoma et al. mentions differences in inversion procedure and difficulties in calibrating charging efficiency of NAIS as some possible reasons for the higher concentrations measured with NAIS. The reader is referred to this paper for more information.

217: sentence end after "coarse modes". New sentence "The differences seen…"

Done.

219: "In the nucleation mode…" -> "In the nucleation mode, the continental air has clearly higher concentrations than marine air during the day (8.00-17.30 h), like the negative ions."

Done.

221: "A similar but stronger pattern…"

Done.

226: "This has been shown to favor NPF…" -> What is 'this' in this case? The free troposphere mixing in and lower the aerosol concentration? You have two sentences in a row starting with 'this' and it starts to become unclear what specific aspects you are referring to. Suggested rephrase here to: "The increase in the mixed layer height has been shown to favor NPF (e.g., Wu et al., 2021) and may explain why we see the highest nucleation mode particle concentrations around the same time".

We changed the text as per your suggestion, that is what we meant.

227: "As can be expected in a location far from major pollution sources…" -> The fact that your measurement station is far from major pollution sources is important! It should be said in the introduction and methods, because it's an important advantage to your measurement station that not everyone will know already.

This is a good point, and it is of course quite subjective what is major or far. We added text "The station is somewhat remote since it is in a nature reserve and the nearest town, Hanko, is approximately 16 km west of the station and has a population of only around 8000 people" to the first paragraph of the introduction and we now also mention the nature reserve in the second last paragraph of the introduction.

227-228: "As can be expected in a location far from major pollution sources, coarse mode particle concentrations were low" -> Low compared to what? Compared to other particle sizes? Compared to polluted regions? Coarse mode particle concentrations are always lower than other sizes, not just in clean regions.

We meant low compared to polluted regions. To clarify this, we added text: "For example, previous work at the Hyytiälä Forest Station, also away from major anthropogenic sources, has observed a 1.2 cm^{-3} mean number concentration of coarse mode particles (Aalto et al., 2001), while here the hourly medians of coarse mode concentrations were below 1 cm^{-3} in both wind sectors."

231: "it is no surprise" -> very colloquial.

Changed to 'predictably'. Do not know if you consider that better.

231: "CS" has not yet been defined as condensation sink.

It has now been defined in Section 2.2., but we also added 'CS' in the beginning of this section for clarity.

230-231: "As the surface area of the particles is dominated by accumulation mode particles, it is no surprise that the CS was higher in marine air." -> Needs more explanation, a step or two were jumped. Suggestion: "Condensation sink was unsurprisingly higher in marine air (particularly between 6.00 and 20.00h) because a) condensation sink depends on total particle surface area, b) total aerosol surface area is dominated by the accumulation mode (having both high number and large size), c) marine air had higher concentrations of accumulation mode particles (Fig. 6c), and d) we have already seen that there were fewer NPFE with marine air which means that condensation sink should be higher."

Good suggestion, we replaced the sentence with the suggestion (using numbers 1), 2) instead of a), b) to be in line with similar sentence structure used in the text previously).

233-235: "Similarly to accumulation mode particles…" -> rephrase: "The difference in condensation sink between the two air masses is clearly during the day (8-17.30h), which is

likely due to boundary layer dynamics, i.e.,…" and then explain specifically which dynamics you mean.

We tried to spell this out and the end of this paragraph now reads: "The difference in condensation sink between the two air masses is clear during the day (8-17.30h), which is likely due to boundary layer dynamics, i.e. increase in boundary layer height during the day diluting particle concentrations in the continental wind sector. Over land, the boundary layer height varies over the day more than over the sea, and as explained earlier, the free troposphere air that gets mixed to the continental boundary layer is likely very clean when the air masses come from the north west. In the marine sector, even if the boundary layer height varies, the air that gets mixed lower is not necessarily cleaner as it has potentially travelled over continental Europe some days earlier."

250: "Figure 8 shows the average 2-2.3 nm ion concentration (chosen as a proxy for NPF) binned with mean wind direction, together with wind speed and relative humidity."

That is not quite how it was meant, we changed the sentence to "Figure 8 shows the average 2-2.3 nm ion concentration (representing local intermediate ion formation) binned with mean wind direction, together with wind speed, total incident radiation and relative humidity."

251: "All the plots show that there are more ions when the wind direction is from the northwest (X°), as we already showed that NPF is most likely to occur in air masses from this direction (Fig. X)."

Done.

253-256: starting with "Sunny conditions", rephrase: "Since sunny conditions favor photochemistry and drive NPF, and relative humidity is often anti-correlated with radiation due to potential cloudy or rainy conditions, we see an anti-correlation of relative humidity with 2-2.3 nm ion concentrations."

Done.

Section 3.3.2: What is the explanation for the correlation with higher wind speeds?

We are unsure of the reason for this and hope that future research on the effect of meteorological conditions could answer this question.

268: "as can be expected from previous results" -> "as we saw in Fig. 8"

Done.

269: "the previous results from the wind direction bin plots" -> "Fig. 8"

Done.

273:" With this limitation..:" -> "With this filter, the 2-2.3 nm ions and temperature are negatively correlated."

Done.

274: Why are warmer air masses more aged and why do they have higher condensation sink?

This sentence was based on our previous experience with data from Hyytiälä. The idea is that if we consider air masses coming from the northwest, in the beginning they come the Norwegian Sea (close to the Arctic-> cold). The more time they spend over land, the more they are warmed by the land since over land the sensible heat flux to the atmosphere if larger than over the sea. Then again, if we consider air masses coming the northwest, the more time they have spent over land, the more time there has been for NPF to happen and for potential anthropogenic emissions to accumulate in the air. Hence higher condensation sink.

We added text "(see e.g. air mass analysis done for Hyytiälä by Räty et al., 2023)", so that interested people can refer themselves to this article which explains this in more detail.

278: "no significant correlation" -> how are you defining "significant"?

Throughout the paper we have used p< 0.05. We added text "(p > 0.05)" here.

279: "limited data" -> "filtered data"

Done.

Figure 9: I would suggest trying to plot this data as 2D histograms (with matplotlib: hist2d) so that you can better see where the data lies. As it is here, all the points are overlapping so it's impossible to see how much data is in the center and where.

We have changed this figure to one made with hist2d.

285: "sub-2nm and 7-25 nm ions which correlate negatively with each other" -> their correlation coefficient is -0.053, which is extremely weak. I would say there is no correlation there. In general, when you describe correlations, you should always provide the R value in parentheses.

We added words 'very weakly' and the correlation coefficient in parenthesis in this sentence. We fear that adding all the correlation coefficients in the text would make the text more laborious to read.

Conclusions last paragraph: Add how your new station specifically can help address these new research questions in the future.

The work we have planned is rather extensive, so it is difficult go through all the details here. We tried to shed some more light on the idea and the last paragraph of the Conclusions now reads: "Overall, our results are well in line with previous research from the thoroughly investigated Hyytiälä boreal forest site. Although clear differences were seen between the continental and marine wind sectors, more research is needed to distinguish how potential coastal sources can influence aerosol formation processes at the Baltic Sea coast and further downwind away from the coast. This will require not only deeper understanding of the local

meteorology and coastal oceanographical processes, but also information about the chemical composition of aerosols and their precursors. The new coastal atmospheric observatory founded in Tvärminne has a key role in understanding these coastal ecosystem atmosphere interactions as we are conducting long-term measurements of thousands of different parameters, ranging from aerosols and trace gases described in this paper, to advanced online mass spectrometry of atmospheric chemistry, as well as green house gas fluxes and sea water properties. These continuous measurements are complimented by lab experiments on topics such as sea-atmosphere fluxes of climatically relevant gases from different ecosystems under different climate conditions. Deep understanding of local meteorological conditions and modelling work are needed to understand how different components interact. All of this work is planned together with experts on coastal biogeochemistry and biodiversity so that eventually we can combine our results to understand how the coastal ecosystem interacts with climate. Long-term measurements are a key to observing how these interactions change over time as the climate changes."

Review of “Measurement report: New particle formation and aerosol properties at a newly founded atmospheric observatory at the Finnish Baltic Sea coast” by Peltola et al.

This study reports on new particle formation at a coastal site, specifically the Finnish Baltic Sea coast. An observatory was formed in 2022 at the Tvarminne Zoological Station (TZS) on the southern coast of Finland which was leveraged in this work for measurements pointing to NPF being just as often as at the well-known boreal forest site in Hyytiala more than 200 km to the north/northeast where many publications have focused on NPF. Interestingly only one third of NPF events occurred at both sites on the same day. NPF was favorable when clean air masses from the Norwegian Sea passed over the boreal forest environment. A nice feature of this study was looking into local intermediate ion formation (LIIF), which informs about NPF potential near the measurement site. Their results suggest that LIIF was more frequent over land versus marine areas due to low condensation sinks and sunny/dry conditions.

The topic of this paper is certainly of interest to this journal. It is a Measurement Report, which lessens the pressure in a way to show very novel results with broad implications. Instead, this paper reports on high quality data at a fairly new site and put the results into context with comparisons to other regions. The paper adds to the growing literature about NPF. The draft is well written with good figures and tables.

The general recommendation is to publish this work after considering minor comments below.

We thank the reviewer for the helpful comments.

Specific Comments:

Line 77-78: The authors mention that the location of the NAIS changed two months into the data collection period. Did this change in location affect any of the results, and was there a specific reason for the location change?

In the beginning the trailer was temporarily located next to the main building of the research station. The reason for this was very practical as no electricity was yet available in the planned measurement location that is right at the coast. No change in results was detected due to the change in location.

Line 95: “based on the”

Fixed.

Line 131-132: “This is why we focus our analysis…”

Fixed.

Line 133: “and larger ions (7-25 nm) that are still…”

Fixed.

Line 139-140: Stitching together size distributions from independent instruments is not trivial. Can the authors provide more details about special considerations and/or uncertainties in their stitching process?

This is true. Here we did not apply any correction factors and used the data as is. NAIS data was used until 40 nm since smaller particles are more sensitive for particle losses, and we assumed that the particle losses for NAIS were smaller than those of DMPS due to NAIS having a shorter and wider inlet with higher flow rate.

Section 3.3.2: this is an important section as this is where identified relationships have broader implications to other regions in contrast to previous sections that are very locally dependent.

We completely agree. Meteorology at a coastal site will always be a key component for any interpretation of results. More detailed analyses related to meteorology and wind direction dependencies are already ongoing and will eventually be a manuscript of its own. Both meteorological conditions and trace gas data are essential for understanding air mass history and in this way the air in which one can expect new particle formation to occur. We hope that the analysis in this paper can help people trying to understand other coastal sites or sites with otherwise variable terrain.

After reading this interesting manuscript, I had a short discussion with the first author (we are working at the same institute) and it turned out that she (and her co-authors) were not aware of previous studies done in same archipelago and ecosystem, with similar instrumentation and methodologies, with similar or longer air mass residence times over the shallow zone along the coast and islands (and with less impacts from the near-by forest ecosystems with high biogenic emissions). Based on our discussion with the first author, we agreed that these three previous studies should be listed here in the discussion, to allow the authors to reflect and contextualize the recent observations against earlier research, in the revised manuscript.

Thank you for pointing out these articles. While we were aware that aerosol measurements have been done at Utö at some point in history, somehow, we missed these articles. While our focus is quite different (specifically coastal environment and local phenomena), these articles are very relevant background information.

We added text to Introduction, line 48: "Aerosol measurements in the Finnish archipelago site, Utö, located 100 km west of Tvärminne, showed that while new particle formation is observed at the site, the source of particle forming vapours seems to be either transport from boreal forest or shipping emissions whereas the Baltic Sea itself seems to be inhibiting particle formation"

Additionally, we added some comparison between the results in these articles and our work.

To line 154, we added text: "The NPF event frequency detected in Tvärminne is close to what has been reported earlier for Utö, located in the outer archipelago approximately 100 km from Tvärminne (Hyvärinen et al., 2008)."

To line 174, we added "This is reasonable as over the sea ionisation happens primarily by cosmic radiation which has no diurnal pattern. For example, Komppula et al. (2007) have estimated that while in Hyytiälä cosmic radiation accounts for 30 % of ion production, in Utö, which is located in the outer archipelago, 100 km west of Tvärminne, cosmic radiation can account for 60-70 % of ion production."

To line 226, we added: "Having higher accumulation mode concentrations in the marine wind sector is also in line with work by Engler et al. (2007) whose source analysis for the Finnish archipelago site Utö showed central to northeast Europe and Great Britain as source areas of higher concentrations of accumulation mode particles."

Hyvärinen A., Komppula M., Engler C., Kivekäs N., Kerminen V.-M., Dal Maso M., Viisanen Y. and Lihavainen H., Atmospheric new particle formation at Utö, Baltic Sea 2003–2005. https://doi.org/10.1111/j.1600-0889.2008.00343.x, Tellus 60B, 345-352, 2008
[new particle formation, event classification analysis; condensation sink, formation and growth rates etc]

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