

## ***Interactive comment on “Terrestrial or marine? — Indications towards the origin of Ice Nucleating Particles during melt season in the European Arctic up to 83.7° N” by Markus Hartmann et al.***

**Anonymous Referee #2**

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In the paper "Terrestrial or marine? - Indications towards the origin of Ice Nucleating Particles during melt season in the European Arctic up to 83.7° N" by Hartmann et al. 2020 the authors present field measurements of INP in the European Arctic across different temperature ranges and try to investigate the sources of these measured INP. To do so additional measurements of INP in bulk sea water, the sea surface microlayer and fog water are done, (satellite) measurements of Chlorophyll-a and air mass history (trajectory model) are analysed. The measurements and analysis are detailed and thoroughly done. Therefore the study is suitable for ACP after some minor revisions.

General comments:

C1

- The paper does and can only answer the INP source question in a very limited way. Even though a lot of different measurements/analysis is used, the conclusions are a bit vague, which is probably due to the complex nature of the research question. They find indications that INP above -15°C are dominantly biogenic, while at lower temperatures dominantly dust (this is not so surprising looking at previous field studies, even though not so many specific studies for the Arctic exist). They state that the sources could be marine, locally emitted for the INP above -15°C, but only if the INP are enriched during aerosolisation by several orders of magnitude. It would be helpful to discuss more critically the limitation of the study, what can be taken from it for which conditions and what needs further investigation. The authors might need to break down the complex research question into subquestions etc..
- Why are two different filter techniques (LINA and INDA) used and what are the advantages/disadvantages of both compared to each other? When is which technique used (figure captions are not always clear on that?)?
- It is not clear where the conclusions come from that the lower temperature INP are dominated by dust (no clear indication from the trajectories?). Is that derived from the slope of the measurement and comparison to other field measurements?
- Section 3.3.1: How large is the variation due to the assumptions made (SS etc.)? Could you add a section on commenting this and or add error ranges depending resulting from the assumptions made? Same for the variable N\_CCN which might affect the result (and comes itself already with an uncertainty).
- How large are the uncertainties in the calculated trajectories? Please comment on limitations here as well.

Specific comments:

- Page 2, line 21 and 22: The sentence on the heat induced reduction... can be removed, this was stated already on page 1, line 9 ff.

C2

- Page 2, line 35-46: It would make sense to switch paragraph line 35-39 with the paragraph line 40-46.
- Page 5, line 127: "within the ice pack" = open leads?
- Page 9, line 246: What is a "vessel's Ferrybox system"? How does it work?
- Page 12, line 290-291: Was the sampling time consistent for all environmental settings or how can that influence the statement?
- Fig. 4: Is that figure needed in this paper?
- Fig. 7: The labels are a bit small here.
- Page 15, line 340: Add: "...can be seen" due to filtration.
- Page 16, line 354-355: Is it legitimate to compare sea water and fog water directly? Is there not a bias due to dilution effects?
- Fig. 11 a: The fit/slope at lower T is very difficult to spot in the graph.
- Fig. 12: Write variables in the caption.
- Fig. 12: The arrows are very small to spot.
- Page 24, line 503: Be more specific what "similar in shape" means.
- Page 25, line 537-538: The most enriched samples featured the highest ice activity.  
-> that refers to the SML samples?

Technical corrections:

- Page 11, line 270: Remove brackets around the temperatures.
- Page 14, Caption Fig. 5: ...the samples were taken from.
- Page 14, Caption Fig. 5: Add a . at the end of the caption.
- Page 20, line 432: Remove the brackets around the citation.

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- Page 21, line 465: Add a space between N\_total, and panel b.
- Page 21, line 470: Add a ; between 0.24... and the reference Bracher, 2019.
- Page 24, line 511: Remove one at.
- Page 26, line 572: Remove one . at the end of the line.

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