Response to Referee #2 (Luis Antonio Ladino)

We thank Luis Antonio Ladino for the positive evaluation of our article. Below, we provide a point-by-point answer to his comments (referee report in blue, our answers in black). The page and line numbers refer to the original manuscript.

General comment:

In the present study the ice nucleation abilities of marine aerosol particles relevant to mixed-phase and cirrus clouds are presented based on previous observations and a new set of experiments. The results and the conclusions from the present study are a great contribution to the ice nucleation community as it helps us to improve the current understanding that marine aerosol particles play in cloud formation. This is a well designed and executed study where the authors paid a lot of attention to each experiment to properly interpret it. The manuscript is very well written with a sound discussion where the potential sources of uncertainties are highlighted and described. The manuscript can basically be accepted as is. However, below five minor comments are included to be considered in the final manuscript.

Minor comments:

Line 44: Add a reference after “235 K”.

Yes – as also suggested by Referee #1, we will cite Koop et al. (2000b) from our reference list.

Line 119: What do the authors mean with “constant composition”?

This refers to the fact that the amount of water vapour within the sealed environmental cell is small compared to the amount of liquid water in the aqueous NaCl solution droplets (with immersed diatom cells). The composition of the solution droplets, i.e., the weight fraction of NaCl, therefore remains constant during cooling because condensation of the available water vapour is negligible compared to the condensed phase water in the droplets. We suggest deleting *"at constant composition"* from line 119 and adding another sentence to explain this in more detail:

“The composition of the NaCl solution droplets remained constant during cooling because the amount of water vapour in the environmental cell was negligible compared to the amount of liquid water in the droplets.”

Line 181: “In particular smaller, 200 nm-sized particles showed”. This does not read properly.

We propose to rephrase this sentence as follows:

“The increase in the organic carbon content after cell lysis was particularly pronounced for smaller particle sizes (200 nm). These 200 nm-sized particles proved to be very efficient INPs,

with ice-active fractions > 1% at S_{ice} >1.18 and corresponding n_s densities that were similar in magnitude to those of other common INPs like mineral and soil dust (Wolf et al., 2019).”

Lines 442-444: Please double check if the sea surface microlayer samples during the ACCACIA expedition were indeed collected using a glass plate.

Thank you for spotting this. The samples during ACCACIA were actually collected from a hydrophilic Teflon film on a rotating drum. We will correct our sentence on line 242 as follows:

“The sea surface microlayer samples from the Eastern Canadian Arctic and the Greenland Sea were collected with the glass plate technique during NETCARE (Irish et al., 2019) and from a hydrophilic Teflon film on a rotating drum during ACCACIA (Wilson et al., 2015) field expeditions …”

Table A1. I do not see the purpose of adding it to the manuscript.

We acknowledge that our discussion is not strongly linked to this table. In the interests of complete documentation, we would still like to include the data. There might be future studies on the ice nucleation ability of sea spray aerosol particles under cirrus conditions (with other field-collected microlayer samples), for which our tabulated data for e.g. dissolved organic carbon (DOC) and bacterial abundance (N_{bac}) could be a valuable reference, as these parameters could affect the observed ice nucleation behaviour.