

Response to Editor's comment

Please find your original comments in blue and our responses in black. When referencing page and line numbers, we are always referring to the latest version of the manuscript.

Comments to the author:

I would like to thank the authors for incorporating the suggestions made by both reviewers. The revised version looks pretty good and it is almost ready for publication; however, I have the following comments before I can accept the manuscript.

Minor Comment:

Please state somewhere that the relevant heterogeneous ice nucleation mode in the present study is immersion freezing, briefly indicating why this mode is important for mixed-phase clouds.

We added the following in Line 23:

“Heterogeneous ice nucleation processes can occur via different pathways, e.g., immersion freezing, deposition nucleation, condensation freezing, and contact freezing (Pruppacher and Klett, 1998; Hoose and Möhler, 2012). Among these, immersion freezing (ice nucleation by solid particles immersed in super-cooled water) is the dominant process for ice nucleation in mixed-phase clouds (Murray et al., 2012).”

We modified the following in Line 76 to clarify that we focus on immersion freezing.

“Secondly, we focus on the immersion freezing behavior of aerosol particles and the derived INP spectra are presented.”

Technical Comments:

Line 6: Based on the heating test, roughly....

We change it to: “Heating of the samples revealed that roughly”.

Line 8: with AN agricultural area in Argentina

Done.

Lines 23: Add a reference after “heterogeneous ice nucleation”.

Done.

Line 24: I think “the frozen ice crystals” is not completely appropriate. How about “nucleated ice crystals”?

We think it is better to remove the “frozen” here, as the “nucleation” is the “birth” of the ice crystal.

Line 34: Add a reference after “Southern Hemisphere”.

Done.

Line 44: “than previously found and found that these”. Please rewrite this.

Changed to “than previous studies and found that these”

Line 51: “the real world”. I think this term is not fully appropriate.

Change it to “Earth”. Now is:

“Since Earth has large spatial heterogeneity and temporal variability,…”

Line 65: Please fix the following sentence “particular, and this is true worldwide and, due”.

Change it to:

“Long-term measurements with high time resolution are needed to understand the aerosol-cloud interaction in general and INP in particular. This is true worldwide and particularly in the region of the Southern Ocean and Southern Hemisphere, due to a still existing lack of data.”

Line 77: Please add the word “inhabitants” after “more than 100000” and also add the corresponding reference.

We added “inhabitants”. The population information is from Wikipedia. Not sure if it is proper to cite Wikipedia information.

Line 79: Add a reference after “landscape of herbaceous vegetation”.

Done.

Line 90: Please add the details of the used sampler.

If I understand correctly, you are referring to Line 89, the sampler for the INP filter.

We added the following:

“The sampler used in this study is a 47 mm single-stage filter holder (Savillex LLC, MN, USA).”

Line 95: Replace “based on more recently” by “based on a recently”

Done. We removed “more”, but did not add “a” because the following word “measurements” is plural.

Line 101: Please state for how long the samples were stored under this conditions previous to their INP analysis.

We added the following:

“The measurements were performed from May to August 2020, and the samples were stored in a freezer for roughly 3-8 months before they are analyzed.”

Line 163: Given that an INP sample was collected for several days, please indicate if the used A to calculate n_s corresponds to the average value for the 7-14 day periods.

We modified and now it is:

“where A is the averaged particle surface area concentration during the corresponding INP collection periods.”

Figure 2: I am wondering if this figure shows circles or dots. Either make the circles bigger or change "circles" by "dots", as well, the figure legend.

Changed “circles” to “dots”.

Line 381: Please avoid using twice “in summary” in the same paragraph.

We removed the 2nd “in summary”.

Line 456: “Punta Arenas (Chile).”

Done.

Line 456: Delete PSSD.

Done.

Figure S1: Replace “surrounding the Punta Arenas” with “surrounding Punta Arenas”.

Delete the “References” subsection in the SI (page 10).

Done.