Response to Referee #2

We would like to thank the referee for their useful comments and have responded below. The referee comments are highlighted in red and our responses are in black.

In this paper, the authors describe the SHARK platform to measure the aerosol size and to sample the aerosols for INP analysis. The platform also deploys meteorological sensors. Size-resolved aerosol and INP measurements within the boundary layer are missing, and I think such a platform in the future can be very useful. The paper is well written. I have a few minor comments that I suggest the authors address before the paper can be published.

1) The importance of aerosol composition towards INP efficiency should be mentioned. Although size is important for transport/dispersion and residence time within the atmosphere; it should be noted that INP efficiency in addition to the size also depends upon the other factors (e.g., composition: e.g., organics vs. dust, particle type: e.g., spherical vs. non-spherical, etc.). Currently, it reads like size is the most important factor that determines the INP efficiency.

We fully agree that size is not the only determinant of ice nucleation and do not suggest it is. We have adjusted the text in the introduction to read:

"While composition is recognised to be an important controller of ice nucleation ability (Kanji et al., 2017), it has also been generally thought that the larger an aerosol particle, the more likely it is to serve as an INP (Pruppacher and Klett, 1997). However, the lifetime of coarse mode aerosol particles decreases rapidly with increasing size."

2) It should be acknowledged that the SHARK technique does not provide spatial and temporal measurements of INP.

It is implicitly acknowledged that instrument does not produce high temporal resolution, since it is a filter-based technique. However, samples from the SHARK can be used to produce a time-series of INP concentrations with a resolution on the order of hours in specific locations. Similarly, when the SHARK is deployed on a tethered balloon, there are no means of making measurements beyond the length of the tether, but the altitude of the SHARK can be controlled within that range.

3) It is not clear regarding the use of equation 3 to calculate Ns. Fice and N are determined using different techniques. It is not clear how the measurements from both techniques can be combined. N quantity (line 414) is the total number of particles, which depends upon the volume of air sampled, duration time, and some particle concentration (#/cc). Is it possible that the number of particles that enter the impactor (section 3.2) might be different than OPC (line 415) because of losses within the impactor?

The following statement has been added to the paper:

"where *N* is the total number of particles sampled by the impactor in each size bin, calculated using the number concentration in each size category as measured by the OPC, and the volume of air sampled by the impactor (see Table S1). The size bins from the OPC which have been included in the calculations were matched to those in the impactors. The bin boundaries for the OPC calculations were within tens of nanometres of the impactor bin boundaries."

In addition, we made considerable effort to quantify losses in the OPC and impactors in order to understand them, as demonstrated in Figure 3. We also plot the collection efficiencies for both impactors in Figure 2 and discuss effects such as bounce in the text.