Response to referee 2

We thank the referee for their comments. Our responses are in blue text.

A - The main message of the manuscript is that a low INP acitivity of the MLB aerosol particles is detected in Barbados and this is most likely due to the low K-feldspar content. I accept this thesis, but find that even more convincing data could possibly have been obtained from the samples taken. Above all, it should be clearly shown that the K feldspar was indeed very low throughout the campaign.
For this purpose, a more precise determination of the real K-feldspar content within the individual samples would be desirable. The manuscript mentions XRD measurements, but only one measurement of a rain sample is presented. Were the daily samples also examined with XRD and if so, what was the variability of the K-feldspar values?

We agree that measurement of K-feldspar content throughout the campaign would have been valuable and if we were to go back and do it again we would have a much stronger focus on the mineralogy. However, measuring mineralogy of airborne dust is not trivial and would require significant investment in higher volume samplers and in the X-ray diffraction technique development. The rain water sample was a one off and opportunistic, where a sample of rain water from the Mesa lab sampler trap happed to have a lot of dust in it, allowing for this XRD analysis. Even this quantity of dust proved challenging to work with. But, this analysis alongside the SEM and literature work all clearly point to a relatively low K-feldspar content.

Otherwise, the K-feldspar content is derived from the scanning electron microscopic data. This is possible in principle, but it requires several things. On the one hand a very low particle assignment of the filter, so that a single particle analysis remains possible and on the other hand the analysis of at least about 100 particles / analyzed size bin. Figure 3 shows the scanning electron microscopic results of 4 samples indicating significant variability (at least with regard to sea salt). Contrary to the figure legend, only percentage values can be seen, not a number of analyzed particles, which would be desirable. I would have liked to support the assumption of the low K-feldspar content in general throughout the campaign either by the XRD data from more samples or electron microscopic data.

The number of particles per bin is already given. These numbers should be more obvious with the higher resolution image that will be supplied for the typesetting.

As mentioned above, we would also have like to have done more work on the mineralogy. We mentioned the limitations of the X-ray diffraction analysis above, but we also unfortunately suffered from problems with our Meslab filter samplers. These samplers cut out at random times and while our plan was to always have at least two concurrent samples, one for INP analysis and one for SEM analysis, this was unfortunately not possible.

B – The discussion on other factors, influencing IN activity (based on literature/comparative values), is generally very thorough and broad. In some cases, there are even repetitions here, which could be avoided by some cuts.
I am not entirely convinced by the discussion about the assumed low influence of internal mixing with sea salt.

We left this somewhat open because we cannot rule it out completely. More work should be done on the role of sea salt in the ice nucleating ability of dust in the future.

In the 4 compositions shown in Figure 3, a larger proportion of external sea salt particles in coarse mode is recognizable in 2 samples. However, the extent to which internal mixing with sea salt was found in the "Al-Si-rich" particles (should be visible in SEM) is not used

for the discussion. Is there SEM data for more samples? This would also help to get an idea of the variabilty of aerosol particle composition. These data could significantly strengthen the discussion and conclusions.

There is certainly a degree of internal mixing. We already mentioned this in section 4 where we state 'The mineral dust was often internally mixed with sea salt, similar to a previous study of aerosol at Ragged Point (Kandler et al., 2018), and sea salt (Na rich category) also appeared as an externally mixed (mostly submicron) particle type.'. We have also added 'Given mineral dust particles are internally and externally mixed with sea salt (Figure 3), we now consider if the salt may have altered the nucleating ability of the dust.' To the beginning of section 6.2.

As discussed above, we had limited number of samples for SEM analysis.

Minor points:
A - Figure 2 shows size distributions. In red those that were determined in the SEM. Size distribution determinations with the help of SEM are difficult and a factor of 2 as an error and a flatter course is quite typical in this type of determination.
The size distribution from SMPS/APS should still have the higher accuracy. Therefore, it would be advisable not to use the size distribution determined with the help of the SEM data but to combine the relative group abundance (SEM data) with the SMPS/APS size distribution in order to achieve the most reliable results.

For the surface areas we used to derive active site densities, we used the APS/SMPS data. Since we only had four SEM size distributions for the reasons defined above, we cannot use the SEM data to routinely come up with a combined size distribution.

B- Line 72 Reischel, 1987 used ammonium iodide. These results are difficult to compare with atmospheric IN measurements.

This reference is cited because it was the first, to our knowledge, to point out that there a solute dependence involving ammonium ions that can enhance nucleation.

References

Kandler, K., Schneiders, K., Ebert, M., Hartmann, M., Weinbruch, S., Prass, M., and Pöhlker, C.: Composition and mixing state of atmospheric aerosols determined by electron microscopy: method development and application to aged Saharan dust deposition in the Caribbean boundary layer, Atmos. Chem. Phys., 18, 13429-13455, 10.5194/acp-18-13429-2018, 2018.