Review of "Ice-Nucleating Particles Near Two Major Dust Source Regions" by Beall et al.

In this paper, the authors describe the immersion ice nucleating particle (INP) concentration from samples collected during AQABA campaign in regions where ambient aerosol population is dominated by mineral dust and sea salt aerosol. Ice nucleation (IN) activity comparison with soil dust is also included. After comparing with several INP parameterizations, the authors highlight the need to propose a parametrization scheme for INP active above -20 °C. The paper fits the scope of ACP. The reported results are novel and of great interest to the IN community. However, the paper could be improved in terms of structure and writing quality before acceptance for publication in ACP.

Please note the reviewer has tried to avoid comments that have already been made by reviewer #1 and #2.

Major comments

1. The sampling of subsurface seawater should be a separate section in parallel with aerosol measurement.
2. Section 3.1 is way too long. The structure and logic flow could be further improved.
3. The soil dust IN results and connection with collected air-borne samples is vague and speculative. Further evidence on chemical or mineralogy links should be presented.

Specific comments

There are some grammatical issues in the manuscript. Below is an incomplete list. Please kindly perform a grammatical and consistency check before resubmission.

L143: Please define SSA.

L155-156： Can organic compounds be heat-liable as well?

L175-177: Please rephrase.

L203: Please double-check the caption of Fig. S3.

L209-226: Since MERRA-2 was detailed in Gelaro et al., 2017, this section contributes little to the major findings of this study. The authors may consider moving this section to supplement.

L211: Replace x and X with ×. Also applies to L253: "-fold". Please perform a consistency check on the usage of abbreviations and symbols throughout the manuscript.

L228-231: As mentioned by the other two reviewers, what is the impact of using different sampling inlets for aerosol and INP measurement?

L235： Lpm -> LPM.

L237-239: Is it possible that such an operation falsely omits the periods when terrestrial pollutants are transported to the sampling ship? The back trajectories in Fig. S9 and S10 suggest that most sampled air parcels passed through continents, which has also been stated by the authors between L419-26.

L250: of collection -> since collection.

L276-278 Please elaborate the sampling setup of field blanks, e.g. how long was the sampling time instead of "momentarily"?

L281 and L290: Please keep consistent notation throughout the paper.

L303-305: The readers would be happy to read such discussion. Can the authors add a comment after the discussion, such as the impact of including all ambient aerosol types that are not IN active on n_S calculation?

L318: Do the authors explicitly state that heating reduced the IN activity of the samples in Methods?

L322: Please rephrase.

L324: The reviewer is no expert in biology, but catalase is supposed to consume instead of being "decomposed by" H_2O_2? Besides, please keep consistent usage of H_2O_2 (and molecular representations for other species) or peroxide.

L348-354: Consider moving to supplement.

L382-385 was left blank. Was it intentionally?

L391: Please define "M18".

L436-437: Please rephrase. IN is more relevant to aerosol number concentration rather than mass concentration.

L453: compare well with Price et al. (2018)?

L451-L456: Can the authors infer the mixing state of dust and marine particles based on the data?

L467-468: Is dust responsible for the observed IN? It might be better to present the IN results of processed samples before discussion. E.g. L494-495.

L472: Please define PDF.

L660: Incorrect parenthesis.

Fig. 2:

- Will it be helpful to distinguish dust- and marine-dominant aerosol population in this figure? Even though the authors declare that there is no common standard to classify dust events.

Fig. 4:

- L508-509: The linear gradient filling in legend marker is misleading. The readers might recognize it as a semi-filled symbol.
- L509: The markers for heat-treated samples are not filled.

Fig. S3:

- The y label is "Sea Salt Mass Concentration" while the caption indicates "dust concentrations".