Review of "Size-dependent ice nucleation by airborne particles during dust events in the Eastern Mediterranean" by Reicher et al.

General comment

This study investigated the ice-nucleating abilities of size-segregated mineral dust particles from seven different events in the Eastern Mediterranean. The ice-nucleating abilities of the collected samples were tested using two different techniques the Weizmann Supercooled Droplets Observation on Microarray (WISDOM) and Bielefeld Ice Nucleation ARraY (BINARY). The authors found a large variability in the INP concentration as a function of the aerosol source. Additionally, supermicron particles were found to be an important contributor to the INP concentration. The authors report that the current data is in agreement with literature data and provided new parametrizations as a function of particle size.

This is an interesting and sound manuscript. The present results are important for the ice nucleation community and can be useful for modelers. The experiments were well designed and were properly executed. The paper nicely fits with the ACP scope and it can be accepted for its publication after the following points are properly addressed.

Major Comment
1. The introduction is too short and important information is missing. For example, it is missing what are the characteristics of mineral dust that makes them good INPs. Also, based on the vast literature data, how aging can modify the ice nucleating abilities of mineral dust particles. How much dust is transported to the Mediterranean annually, and when does it happen. It may be important to briefly mention that the presence of mineral dust not only affect cloud formation. What other impacts can be assigned to the presence of mineral dust?
2. I found the inter-comparison of the current data with literature data very selective. I suggest to add other previous studies to provide more robust and solid conclusions.
3. Given that particle size is the focus of this manuscript, I am surprised this was not deeply discussed in the manuscript. What was found before this study in terms of particle size vs. ice nucleating abilities of different aerosol particles? Is the current data in agreement with previous studies? What fraction of the INPs measured in the current study correspond to super-micron size particles?
4. I suggest to improve the English in the revised version.

Minor comments
1. Lines 132-133: What is the reason of using two different cooling rates, and why the transition was made at 263K?

2. Line 224 and along the text + Figures: I suggest change the units to L^{-1} as this is commonly used in the ice nucleation community.
3. Lines 246-247: "indicates that the supermicron particles are better INP than the submicron ones". Is this in agreement with literature? Please add a proper discussion here.
4. Lines 238-239: I am wondering if the agreement will be improved if the parametrization is based on total particles and not divided by size. This may be a better comparison with literature data.
5. What is the effect of marine aerosol. The back trajectories show that there is chance that marine particles can affect the ice nucleating abilities of the Saharan dust particles. This is not mentioned/discussed at all.
6. Line 348: I suggest to add a little discussion here on how large or small is this number in comparison to the INP concentrations reported in other environments or parts of the planet (e.g., Polar regions, marine, agricultural, tropics, etc).
7. Figure 9: what of the samples tested in Boose et al. (2016b) are shown here? Pleas add this to the main text as well.

Technical comments
Line 34: Add a reference after "troposphere" and after "climate".
Line 36: "Key properties" such as?
Line 37: …in THE characterization.
Line 40: "most prominent". What does it mean?
Line 45-46: "Field observations have identified an increase in INP concentrations and ice clouds formation in the presence of mineral dust". Are these the only 2 studies that found this?
Line 51: Add a reference after "calcite".
Line 55: "and suggested its importance for atmospheric ice formation". This reads a bit awkward.
Line 56: "quartz mineral phases". What does it mean?
Line 61-62: "While there are only few measurements of AMD near source regions". Just Price et al. (2018)?
Line 63: Please add more studies together with the Niemand et al., (2012) study.
Line 64: Add a reference after "AMD".
Line 64: Surface-sampled natural...
Line 65: "to laboratory processes" such as?
Line 72-77: This belongs to the methodology section.
Line 88: I think it is redundant to write MOUDI impactor. I suggest to briefly describe the MOUDI principle.
Line 107: What is close?
Line 112: "particle surface area assumed sphericity and diameter was taken as the midpoint of the GRIMM's channels". This is unclear.
Line 120: "optical diameter > 17.5 µm are assumed to be collected". Is it a good assumption?
Line 122: "of 0.5 µm". Optical diameter?

Line 123: "The initial particle concentration that was used". What does it mean?

Line 126: "Immersion freezing properties". What does it mean?

Line 128: "30 sec" should be 30 s.

Lines 132-133: "10 K min-1" should be 10 K min^{-1}.

Line 145: "ice nuclei" should be INP.

Line 145: Do the authors refer to water when talking about a solvent?

Line 157: "ice nucleating particle" should be INP.

Line 170: "travelled directly to the sampling site" from where?

Line 212: "burnings" remove the "s".

Line 217: initiated?

Line 218: Add a reference after "concentrations".

Line 239: "increased with the particle size" delete "the".

Line 240: "the activity was similar" between what?

Line 247: "implying they have better active sites". Better or more? What do the authors mean with better?

Line 256: "important ice-inducing component". What does it mean?

Line 262-264: I found this quite speculative.

Line 324: "Boose et al. (2016)" should be Boose et al. (2016b).

Lines 330 and 333: "$(R - square)$". Fix this.

Line 364: Add a reference after "distance".

Line 365: Add a reference after "scale".

References: DOIs are missing and either use the full name or abbreviated name of the journals. Need to be consistent.

Figure 3: "distributions averaged over the entire sampling periods" events?

Figure 4 and 5: Change the units of the INP concentration to L^{-1}.