

Interactive comment on “Comparing contact and immersion freezing from continuous flow diffusion chambers” by Baban Nagare et al.

Anonymous Referee #3

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My major comment is that main conclusions of the paper are not visible. Some revision is needed to enhance the readability, and also it is necessary to clarify what are the major conclusions of the paper. It is also not clear why this study is important, and what the atmospheric implications are. Some more discussion is needed to understand why AgI, ATD and Kaolinite particles were used, why natural dust or soil dust particles were not chosen as these are more atmospherically relevant. This is nice study, overall contact freezing is not well understood, but main message is buried. Below some comments may help to revise this paper further.

-What is the typical size of supercooled droplets observed in mixed phase clouds? How often 80 μm droplets are observed. Atmospheric relevance of droplet size should be discussed.

C1

-Following two sentences (i and ii) needs to be elaborated. Bulk liquid water properties are different from individual water droplet properties. Please define what you mean by sprinkling. Do particles were size-selected, how many particles were used, what is the temperature of the liquid water, do water is pure or distilled or regular lab supply grade, how long this experiment was performed, do all particles sediment, and how this observation was made (visual observation, microscope).

(i) “When we sprinkled ATD on a water surface, most particles immediately immersed and sank to the bottom. This suggests that when ATD particles collide with water droplets, the particles become immediately immersed such that in immersion freezing and contact freezing experiments the immersion mode is probed.”

(ii) “When we sprinkled kaolinite powder on water, we observed that some particles floated on the surface while others became totally immersed and sank to the bottom.”

-It is mentioned that “A particle on the surface can induce ice nucleation in the immersion mode with the part immersed in water or in contact mode with the part exposed to air.” How this can be assumed, what is the basis for this?

-Section 5.6: It is not clear what results are discussed. This section looks like reading a literature review. There is only one sentence (The immersion and contact freezing studies compiled in Fig. 6 suggest that contact freezing is more efficient than immersion freezing with an onset temperature that is about 3 K higher), which describes the results, but there is no discussion. I suggest use present results to discuss the figure 6, but not previous results (as they have different instrument platform to study Kaolinite properties). For example XRD analysis of Kaolinite particles differ from group to group because of the XRD instrument sensitivity issues, and also impurities within the Kaolinite samples. Note that Kaolinite from different vendors have different properties, also shown by Wex et al (<http://www.atmos-chem-phys.net/14/5529/2014/acp-14-5529-2014.pdf>) who shown ice nucleating properties are sensitive to the particles procured from different vendors.

C2

-Section 5.6: Second paragraph. How this is applicable to the present study. This material is not relevant, if yes please discuss how. As mentioned above this reads like a literature review.

-Please see Section 5.5 too. Discuss the present results. There is lot of discussion on previous studies, but how they are related to this study. It is not clear why these studies are discussed. I suggest move this material to Intro section to increase the readability.

-Last three sentences from Conclusion section (page 14, line 8-11). Do authors performed any experiments to conclude this, or these are the conclusions from previous studies. If later then I suggest move this to intro section.

-Can majority of Section 5.2 (except page 17, line 17-23) and Section 5.3 be moved to Intro section? They do not discuss any results.

-It may be a good idea to combine section 4 and 5. Section 5, for dust particles, has lot of discussion concerning previous studies and may help to increase the readability.

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