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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurements of ice nucleation by mineral dusts in the contact mode" *by* K. W. Bunker et al.

L. A. Ladino Moreno

luis.ladinomoreno@utoronto.ca

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Bunker et al. present experimental results on contact freezing using kaolinite and ATD particles as ice nuclei in a cold plate. The authors observe that kaolinite is not able to nucleate ice at temperatures above -18C and ATD at temperatures above -15C. Additionally, the authors claim that an IN size effect was also observed. The studies presented in this manuscript are valuable for the ice nucleation community, however I would like to point out a number of important points where I feel the paper could be improved:

1. Important literature studies are missing in the introduction (e.g., Pitter and Pruppahcer (1973), Rosinski and Nagamoto (1976), Levin and Yankofski (1983), Diehl and Mitra (1998), Diehl et al. (2002), Von Blohn et al. (20050, Durant and Shaw (2005),

among others) and the role of contact freezing in cloud formation and its role in the hydrological cycle and the global radiative balance is not fully explained. Why is it important to study contact freezing and why is it believed to be the most efficient ice nucleation mode? Please provide some evidences from previous studies. Although the focus of the paper is mineral dust particles, it is worthwhile to discuss the very high onset freezing temperatures observed from bioaerosols (e.g. Levin and Yankofski (1983), Diehl et al. (2002)).

2. The obtained experimental results are compared with Svensson et.al (2009) and Ladino et.al (2011) but they are not compared with Pitter and Pruppacher (1973) who also used kaolinite particles in the contact freezing mode. Are the kaolinite samples used in Ladino et.al (2011), Svensson et.al (2009) and the present study the same? The purity of those samples is an issue and could explain the observed differences in the onset freezing temperatures as highlighted by Broadley et al. (2012).

3. As highlighted by Reviewer #1, the dynamical forces responsible for the collisions between the aerosol particles and the droplets in this study are not discussed. Do the collision rates agree with theoretical calculations? How important are the phoretic forces in your system? What is the relative humidity of the air mass carrying the aerosol particles? Is the droplet size controlled/measured and is droplet evaporation considered?

4. Since the authors claim that there is turbulence inside the chamber, how does it affect the collision rates as compared to a laminar flow (e.g., Vohl et al. (1999))? Are there any particle losses due to turbulence?

5. Since the collision efficiency strongly depends on the aerosol particle size, I am concerned about the "monodispersity" of the size selected particles (especially for large particles). How accurate are the IN particle sizes and how narrow are the monodisperse size distributions?

6. It was mentioned in the text that the number of deposited particles was calculated

only for 500 and 1000 nm particles but not for the smaller ATD particles presented in figure 3. Why not? How is it possible to present an error bar for those small particles? What is the utility to calculate CE and how was it used to interpret your results? How do you define the number of freezing events if only one droplet is used?

7. Ladino et al. (2011) did not determine any experimental collection efficiencies. Those values were determined in Ladino et al. (2011a), however the methodology used to calculated CE in Ladino et al (2011a) is wrongly described at present. Aerosol particles and cloud droplets were injected into CLINCH to allow collisions between them. At the bottom section of the chamber, the total injected droplets and the aerosol particles captured by those droplets were collected in a plastic bottle in order to determine the total aerosol mass (by ICP-MS) to calculate the collection efficiencies.

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