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Freezing efficiency of Silver Iodide, ATD and Kaolinite in the contact freezing mode

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The importance of heterogeneous ice nucleation via contact freezing is one of the open questions in the atmospheric science community. In our laboratory, we built the Collision Nucleation CHamber (CLINCH) (Ladino et al. 2011) in which falling cloud droplets can collide with aerosol particles. In this study, contact freezing experiments are conducted to investigate the ice nucleation ability of silver iodide (AgI), kaolinite and Arizona Test Dust (ATD). Silver iodide has been known for its ice nucleation ability since 1940s (Vonnegut 1947) while kaolinite is a clay mineral and known to be a moderate ice nucleus. ATD is a commercial dust sample used by many groups to compare different setups. In CLINCH, size selected aerosol particles collide with water droplets of 80 μm diameter. With the extension in chamber length it is possible to vary the interaction time of ice nuclei and the droplets. Our experiments are performed between -10 to -36 ºC for various concentrations of ice nuclei and different interaction times. The frozen fraction of the droplets is determined using the custom-made depolarization detector IODE (Nicolet et al., 2010). Depolarization of linearly polarized incident laser light is used to determine the ratio of frozen droplets to all droplets. Frozen fractions of the three particle types with different residence times from CLINCH will be presented in this study. The number of collisions between a single droplet and several aerosol particles can be calculated by accounting for the theoretical collision efficiency at the experimental conditions in order to obtain the freezing efficiency (frozen fraction/number of collisions). Nucleation efficiency is compared with other contact freezing studies and with immersion freezing