

Immersion and contact freezing experiments in the Mainz wind tunnel laboratory

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Immersion and contact freezing are of outmost important ice nucleation processes in mixed phase clouds. Experimental studies are carried out in the Mainz vertical wind tunnel laboratory in order to characterize these nucleation processes for different ice nucleating particles (INP), such as for mineral dust or biological particles. Immersion freezing is investigated in our laboratory with two different experimental techniques, both attaining contact-free levitation of liquid droplets and cooling of the surrounding air down to about -25 °C. In an acoustic levitator placed in the cold room of our laboratory, drops with diameters of 2 mm are investigated. In the vertical air stream of the wind tunnel droplets with diameter of 700 micron are freely floated at their terminal velocities, simulating the flow conditions of the free atmosphere. Furthermore, the wind tunnel offers a unique platform for contact freezing experiments. Supercooled water droplets are floated in the vertical air stream at their terminal velocities and INP are injected into the tunnel air stream upstream of them. As soon as INP collides with the supercooled droplet the contact freezing is initiated.

The first results of immersion and contact freezing experiments with cellulose particles both in the acoustic levitator and in the wind tunnel will be presented. Cellulose is considered as typical INP of biological origin and a macrotracer for plant debris. Nucleating properties of cellulose will be provided, mainly focusing on the temperature, INP concentration, and specific surface area dependences of the freezing processes. Direct comparison between the different experimental techniques (acoustic levitator and wind tunnel), as well as between nucleation modes (immersion and contact freezing) will be presented. The work is carried out within the framework of the German research unit INUIT.