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New cloud chamber studies on the ice nucleation efficiency of airborne bacteria

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The ice nucleation activity (INA) of bacterial species is known since several decades and was investigated in many laboratory studies. Some studies also addressed the role of INA bacteria on the formation of clouds and in particular the initiation of precipitation through the ice phase in clouds at temperatures below 0C. This is important because bacteria are among the aerosol particles to initiate ice formation at the warmest temperatures. However, the detailed microphysical processes in such clouds are far from complete or satisfactory understanding. Recently, new interest emerged on the assessment of sources, distribution, characterisation, and impacts of atmospheric bacteria and other biological particles directly emitted to the atmosphere. We have used the AIDA (Aerosol Interaction and Dynamics in the Atmosphere) cloud simulation chamber of Forschungszentrum Karlsruhe for new experiments on the ice nucleation efficiency of several Pseudomonas syringae species in the aerosol and droplet phase at temperatures between 0 and -15C. Suspensions of cultured cells in water were directly sprayed into the large aerosol chamber (84 m3 volume) at temperatures between -2 and -10C. Resulting aerosol size distributions measured with a scanning mobility instrument and an aerodynamic particle spectrometer showed two distinct particle modes, a narrow, almost mono-disperse peak of intact cells with aerodynamic diameters of about 0.8 m and a poly-disperse mode of smaller particles with diameters between about 10 and 500 nm composed of residual particles from evaporating droplets. The contribution will briefly summarize the experimental methods and discuss results about the number fraction of INA cells immersed in supercooled droplets.

Keywords: bacteria, icenucleation, aida