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# Contact nucleation of ice induced by biological aerosol particles

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The contact freezing of supercooled water droplets is one of the potentially important and the least understood heterogeneous mechanism of ice formation in tropospheric clouds. On the time scales of cloud lifetime the freezing of supercooled water droplets via contact mechanism may occur at higher temperature compared to the same IN immersed in the droplet. Recently we have developed an experimental method allowing for quantification of the freezing probability on a single droplet-particle collision event [1]. In the previous experimental studies with mineral dust (kaolinite, illite, feldspar, and hematite) we have been able to show that the rate of freezing at a given temperature is governed by the rate of droplet – particle collisions, and by the properties of the contact ice nuclei: its size, morphology and composition [1, 2]. In this contribution, we focus on the contact freezing efficiency of biological ice nuclei. We demonstrate that the contact freezing efficiency of Snomax (freeze-dried fragments of Pseudomonas syringae bacteria) follows very similar pattern observed in immersion freezing experiments, indicating that the INA-protein identified as the ice nucleation agent in the immersion freezing mode is also responsible for initiation of contact freezing. The same similarity is observed for contact freezing induced by semi-dry residual particles of birch pollen washing water, providing an evidence for the importance of organic macromolecules of biological origin for nucleation of atmospheric ice. Finally, our experiments show that mixing the birch pollen washing water with mineral dust (illite) significantly increases the IN efficiency of mineral dust and extends the temperature range of its IN activity. These findings suggest a possible route of multiplication of the effect of biological IN beyond observed atmospheric concentrations of pollen grains.

[1] – Hoffmann, N., Kiselev, A., Rzesanke, D., Duft, D., and Leisner, T.: Experimental quantification of contact freezing in an electrodynamic balance Atmos. Meas. Tech., 6, 2373-2382, 2013.

[2] – Hoffmann, N., Duft, D., Kiselev, A., and Leisner, T.: Contact freezing efficiency of mineral dust aerosols studied in an electrodynamic balance: quantitative size and temperature dependence for illite particles, Faraday Discuss., 2013.