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Immersion freezing of birch pollen washing water

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Up to now, the importance of pollen for atmospheric ice nucleation was considered to be minor, as they are too large to stay in the atmosphere for a long time. But as recent investigations have shown, not the pollen grains themselves are responsible for freezing, but easily suspendable macromolecules on their surfaces (Pummer et al., 2012). Due to the bursting of pollen grains these ice nucleating active (INA) macromolecules could be numerous in the atmosphere.
In the present study, the immersion freezing behavior of birch pollen, i.e. its ice nucleating active (INA) macromolecules, was investigated at the Leipzig Aerosol Cloud Interaction Simulator (LACIS, Hartmann et al., 2011). For this, washing water of two different birch pollen samples with different origin (Northern birch and Southern birch) were used.
Immersion freezing of droplets generated from the pollen washing water was observed at temperatures higher than -20 °C for both samples. The main difference between the Northern and the Southern birch pollen was the temperature dependence of the immersion freezing process. Our results suggest that the ice nucleating potential of the Southern birch is controlled by a single type of INA macromolecule, while the Northern birch pollen seem to feature two distinctively different types of INA macromolecules.
We determined the heterogeneous nucleation rates for both INA macromolecule types and thereby consistently describe the ice nucleation behavior of both, the Southern and the Northern birch pollen washing water.
Furthermore we will suggest a theoretical framework for describing e.g. single INA macromolecule related ice nucleation in atmospheric models.

References:

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