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Single ice crystal measurements during nucleation experiments with the depolarization detector IODE

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Abstract. In order to determine the efficiency of different aerosol particles to nucleate ice, an Ice Optical DEpolarization detector (IODE) was developed to distinguish between water droplets and ice crystals in ice nucleation chambers. A laser beam polarized linearly (power: 50 mW, wavelength: 407 nm) is directed through the chamber. The scattered light intensity from particles is measured at a scattering angle of Θ=175° in both polarization components (parallel and perpendicular). The ratio between the perpendicular intensity over the total one yields the depolarization ratio δ. Single particle detection is possible, using a peak detection algorithm. For high particle concentrations, a real-time signal averaging method can also be run simultaneously.

The IODE detector was used in connection with the Zurich ice nucleation chamber during the ICIS 2007 workshop where ice nucleation experiments were performed with several aerosol types. In presence of ice crystals, a depolarization ratio could be measured on a particle-by-particle basis. Mean values of δ ranged from 0.24 to 0.37 and agree well with theoretical calculations.

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