Geophysical Research Abstracts
Vol. 16, EGU2014-2762, 2014
EGU General Assembly 2014

A new optical ice particle counter at LACIS

Henner Bieligk (1), Georg Sebastian Voelker (1,2), Tina Clauss (1), Marius Grundmann (3), and Frank Stratmann (1)

(1) Leibniz Institute for Tropospheric Research, Permoserstr. 15, 04318 Leipzig, Germany (henner@tropos.de), (2) Universität Bremen, Center for Marine Environmental Science, Leobener Str., 28359 Bremen, Germany, (3) Universität Leipzig, Faculty for Physics and Earth Sciences, Institute for Experimental Physics II, Semiconductor Physics Group, Linnéstr. 5, 04103 Leipzig, Germany

Clouds play an important role within the climate system, especially for the radiative energy budget of the earth. The radiative properties of a cloud depend strongly on the fractions of ice crystals and water droplets, their size distributions, and the ice crystal shapes within the particular cloud. One option to gain this kind of information is using optical particle counters.

A new optical particle counter is developed for laboratory work and is based on the concept of the *Thermostabilized Optical Particle Spectrometer for the Detection of Ice Particles* (TOPS-Ice, Clauss et al., 2013). TOPS-Ice uses linearly polarized green laser light and the depolarization of the scattered light at a scattering angle of 42.5° to discriminate between liquid water droplets and ice crystals in the lower μm range. However, the measurements are usually limited to ice fractions in the order of 1%. To improve the determination of the ice fraction, several modifications of the original setup are implemented including an additional detection system at another scattering angle. The new scattering angle is optimized for least interference between the droplet and ice signals. This is achieved by finding the angle with the maximum difference in scattered intensity of water droplets compared to ice crystals with the same volume equivalent diameter. The suitable scattering angle of 100° for linearly polarized light was chosen based on calculations using T-Matrix method, Lorenz-Mie theory, Müller matrices and distribution theory.

The new optical setup is designed to run in combination with a laminar flow tube, the so-called *Leipzig Aerosol Cloud Interaction Simulator* (LACIS, Stratmann et al., 2004; Hartmann et al., 2011). Using LACIS and its precisely controlled thermodynamic conditions, we are able to form small water droplets and ice crystals which will then be detected, classified and sized by our new optical device. This setup is planned to be tested in ice measurements including Snomax® and several dusts (e.g. illite, kaolinite, ATD) as ice nuclei which all show different behaviors in ice formation. Furthermore, a detailed comparison of both instruments TOPS-Ice and the new setup is planned.

This project is part of the *Leipzig Graduate School on Clouds, Aerosols and Radiation* and is partly supported by the *German Research Foundation* (DFG project WE 4722/1-1) within the DFG Research Unit FOR 1525 *INUIT*.

Clauss, T., Kiselev, A., Hartmann, S., Augustin, S., Pfeifer, S., Niedermeier, D., Wex, H., and Stratmann, F, 2013, *Application of linear polarized light for the discrimination of frozen and liquid droplets in ice nucleation experiments*, Atmos. Meas. Tech., 6, 1041-1052.

Hartmann, S., Niedermeier, D., Voigtländer, J., Clauss, T., Shaw, R. A., Kiselev, A., and Stratmann, F., 2011, *Homogeneous and heterogeneous ice nucleation at LACIS: operating principle and theoretical studies*, Atmos. Chem. Phys., 11, 1753-1767.

Stratmann, F., Kiselev, A., Wurzler, S., Wendisch, M., Heintzenberg, J., Charlson, R. J., Diehl, K., Wex, H., and Schmidt, S., 2004, *Laboratory Studies and Numerical Simulations of Cloud Droplet Formation under Realistic Supersaturation Conditions*, J. Atmos. Oceanic. Technol., 21, 876-887.