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Measurements of atmospheric ice nuclei using a vacuum diffusion chamber and CCD detection

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Ice nuclei (IN) are an inevitable ingredient in the formation of cloud ice and mid-latitude precipitation. Knowledge of their number concentration and activation temperature is essential for the initiation of ice in numerical cloud and weather models, and any understanding of cloud development. Sources and composition of IN are not well characterized. The SFB 641 subproject A2 “The Constitution and Distribution of atmospheric ice nuclei (IN)” attempts to characterize the airmasses over Central Europe with respect to their number concentration of ice nuclei. Measurements are routinely taken at the Taunus Observatory (825 m alt.) close to Frankfurt/M. Participation during CLACE 5 at the Scientific Station Jungfraujoch allowed us to sample the free troposphere over Central Europe, and supplied a wealth of supporting information.

Samples of ambient aerosol (several hundred liters of air) were taken on filters, to be analyzed subsequently for IN number. Between February 20 and March 21, 2006 we took a consecutive series of 51 sets of two parallel filter samples (Millipore black membrane filters, 47mm diameter, 0,45μm poresize, mixed ester cellulose) on the measurement platform at the Sphinx Oberservatory. Filters were loaded for 12 hours. In addition, filters were sampled downstream of the Counterflow Virtual Impactor (CVI) that was operated by the IFT Leipzig.

For the measurement of IN number, filters are exposed to sub-freezing temperatures and ice supersaturation in the FRIDGE Chamber (Frankfurt Ice-nuclei deposition freezing experiment). Ice-nuclei on top of the filter surface that grow to macroscopic ice crystals are observed by a CCD camera, and are counted automatically within a Labview-Vision™ environment. Since the coordinates of each individual ice particle on the filter are recorded, the filters can be reanalyzed by electron microscopy (Tech-

nical University of Darmstadt, TUD) for chemical composition and morphology at the nucleating sites. In particular the Environmental Scanning Electron Microscope (ESEM) at TUD will be used, which allows to nucleate ice on the sample and analyse the nucleating sites. From these analyses we hope to gain information on the anthropogenic and natural sources of ice nuclei. The activation temperatures of kaolinite, illite and silver iodide test dusts were analyzed and compare well to published data.

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