

Name of research institute or organization:

**Institut für Atmosphäre und Umwelt, J.W. Goethe Universität
Frankfurt**

Title of project:

Ice-nuclei concentration and dewpoint measurements during CLACE5.

Project leader and team:

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Project description:

Several subprojects of the DFG collaborative-research-centre SFB 641 “The Tropospheric Ice-Phase” participated in the Cloud and Aerosol Characterisation Experiment 5 (CLACE 5) at the Research Station Jungfraujoch in 2006. We report here on activities of the two particular subprojects A1 and A2 during CLACE 5.

Subproject A2, entitled “The Constitution and Distribution of atmospheric ice nuclei (IN)”, attempts to characterize the different airmasses over Central Europe with respect to their number concentration of ice nuclei (University of Frankfurt), and investigates the composition of ice nuclei (Prof. Weinbruch, Technical University Darmstadt, TUD).

Ice nuclei 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 project operates routinely from the Taunus Observatory (825 m alt.) close to Frankfurt. 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) were taken on filters, to be analyzed subsequently for IN number (Frankfurt) and chemical composition (TUD).- 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 Observatory. 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 (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 processing of the samples from CLACE 5 is not yet finished.

Within the second subproject A1 “Development of a fast ice nucleus (IN) counter“, we have tested during CLACE 5 at the Scientific Station Jungfraujoch a new Frost- and Dew Point Hygrometer. This sensor will be applied to measure dewpoint and supersaturation both in the atmosphere and in the Fast Ice Nucleation Chamber (FINCH) that is currently under development within SFB 641. We have recently developed this dew point measurement system on the basis of a dew-sensor chip originating from the CIS-Institute, Erfurt, Germany. In contrast to commercially available instruments, this system is small, fast and able to measure in water super saturated surroundings with a high precision. After the first tests at the AIDA Chamber in Karlsruhe, Germany and during the CLACE 5 campaign this dewpoint sensor has been integrated into the FINCH IN counter and in the airborne Passive Airflow Dewpoint Detection Assembly (PADDY) first flown in a Learjet wingpod during the CIRRUS III campaign, in November 2006.

Key words:

Ice nuclei, tropospheric ice phase

Internet data bases:

<http://www.sfb641.uni-frankfurt.de>

Collaborating partners/networks:

Johannes Gutenberg-Universität, Mainz
Technische Universität, Darmstadt

Scientific publications and public outreach 2006:

Conference papers

Bundke, U. et al., The FRIDGE Frankfurt “In Deposition freezinG Experiment”, Proceedings of the IAC2006, Page 1437

U. Bundke, H. Bingemer, T. Wetter, B. Nillius, R. Jaenicke, The FINCH (Frankfurt Ice Nuclei Chamber) Counter - new developments and first measurements. Proceedings of the IAC2006 (p.1350)

Nillius, B., R. Jaenicke, H. Bingemer, T. Wetter, U. Bundke, Model calculations and characterisation of the fast ice nucleus counter FINCH. Proceedings of the IAC 2006 p.1436

Theses

Kleinin, Holger, PhD Theses: “Die Konzentrationen von Eiskeimen in Mitteleuropäischen Luftmassen” in preparation 2007.

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