

Name of research institute or organization:

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**Particle Chemistry Department  
Institute for Atmospheric Physics, University of Mainz  
and Max Planck Institute for Chemistry, Mainz**

Title of project:

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Cloud and Aerosol Characterization Experiment 5 (CLACE 5)

Project leader and team:

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Dr. Joachim Curtius, project leader

Dr. Ernest Weingartner, Dr. Martin Gysel, Dr. Johannes Schneider, Dr. Michael Kamphus, Dr. Ulrich Pöschl, Dr. Elke Fries, Dr. Ulrich Bundke, Dr. Martin Ebert, Dr. Daniel Cziczo, Dr. Olaf Stetzer, Dr. Frank Wienhold, Dr. Richard Winterhalter, et al.

Project description:

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The properties of clouds in the atmosphere have a major influence on Earth's climate and on the hydrological cycle. Therefore, a detailed understanding of the microphysical and radiative properties of clouds is essential. Atmospheric aerosol particles interact with clouds and influence the cloud formation.

Ice nuclei are aerosol particles that lead to the formation of primary ice particles in the atmosphere by heterogeneous nucleation. These are of special interest for the formation of mixed phase clouds, i.e. clouds that exist at temperatures where supercooled water droplets as well as ice particles are present inside the clouds. These types of clouds are often present at the altitude of the Jungfraujoch research station and make this station a unique place for ground-based in situ studies of mixed-phase clouds.

The German Collaborative Research Center 641 "The Tropospheric Ice Phase" (SFB "TROPEIS"), funded by the German Research Foundation DFG, comprising 14 different scientific sub-projects, focuses on research concerning ice particles in the atmosphere. Therefore, a major fraction of the CLACE 5 experiments was conducted and funded within the framework of the SFB "TROPEIS", namely the contributions by the University of Frankfurt, the Technical University of Darmstadt, the University of Mainz and the Max-Planck-Institute for Chemistry in Mainz.

The CLACE 5 experiment was the fifth intensive field mission on the characterization of clouds and aerosol carried out at the High Alpine Research Station Jungfraujoch. The experiment took place from 6 February, 2006, to 25 March, 2006, with an intensive measurement period from 20 February to 21 March. Numerous cloud events were sampled during this time.

For the CLACE mission in 2006 more than 50 individual scientists and technicians came up to the High Altitude Research Station Jungfraujoch to take part in the measurements directly. The Spinx lab and its outside platforms hosted more than 25 additional instruments, including:

- 3 different aerosol mass spectrometers,
- an ice nucleus counter (INC),
- a cloud condensation nucleus counter (CCNC),
- numerous condensation nucleus counters (CNC),

- optical aerosol counters (OPC),
- several different soot monitors,
- scanning mobility particle sizers (SMPS),
- a forward scattering spectrometer probe (FSSP),
- a cloud imaging probe (CIP),
- a digital holographic ice particle imager,
- backscatter sondes,
- a nephelometer
- a particle volume monitor (PVM)
- a gas chromatograph
- an ice counterflow virtual impactor (Ice-CVI)
- several particle impactors for off-line analysis
- filter samplers for off-line analysis
- snow samplers
- ice and graupel samplers

Several of these instruments were entirely new developments and were tested for the first time in the field, for example, the ice nuclei counter from ETH Zürich, as well as the single particle aerosol mass spectrometer and the digital holography instrument from the University of Mainz. Three different inlet systems were used to sample the aerosol and the cloud elements. The photographs show a group of researchers involved in CLACE 5 on the platform of the Sphinx laboratory and an impression of the Sphinx laboratory is given, crowded with the equipment.



A first data workshop to present and discuss the data obtained during CLACE 5 was carried out at the Max Planck Institute for Chemistry in Mainz from 28 to 29 September 2006. The 15 oral presentations of the workshop are available on the CLACE FTP-server.

To review the various scientific results of the measurements is beyond the scope of this report. Please consult the sub-project's individual reports for further details.

Key words:

ice nuclei, mixed phase clouds, ice phase, CLACE

Internet data bases:

An FTP-server for internal use by all CLACE participants has been established.

Collaborating partners/networks:

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Institutions and investigators participating in CLACE 5:

Institut für Troposphärenforschung, Leipzig: Dr. Stephan Mertes, Prof. Jost Heintzenberg

Labor für Atmosphärenchemie, Paul-Scherrer-Institut, Villingen: Dr. Ernest Weingartner, Dr. Martin Gysel, Julie Cozic, Dr. Bart Verheggen, Prof. Urs Baltensperger

Institut für Atmosphäre und Klima, Eidgenössische Technische Hochschule Zürich, Zürich: Dr. Daniel Cziczo, Dr. Olaf Stetzer, Stephane Gallavardin, Dr. Frank Wienhold, Prof. Thomas Peter, Prof. Ulrike Lohmann

Institut für Mineralogie, Technische Universität Darmstadt, Darmstadt: Dr. Martin Ebert, Annette Worrigen, Prof. Stephan Weinbruch

Institut für Atmosphäre und Umwelt, Johann-Wolfgang-Goethe-Universität, Frankfurt: Dr. Elke Fries, Dr. Ulrich Bundke, Karsten Sieg, Prof. Wolfgang Jaeschke, Prof. Ulrich Schmidt

Institut für Physik der Atmosphäre, Johannes-Gutenberg-Universität, Mainz: Dr. Joachim Curtius, Dr. Michael Kamphus, Dr. Hermann-Joseph Vössing, Sebastian Raupach, Prof. Heini Wernli, Prof. Stephan Borrmann

Institut für Geowissenschaften, Johannes-Gutenberg-Universität, Mainz: Markus Maria Miedaner, Prof. Michael Kersten

Max-Planck-Institut für Chemie, Mainz: Dr. Johannes Schneider, Saskia Walter, Silke Hings, Dr. Frank Drewnick, Dr. Ulrich Pöschl, Diana Rose, Göran Frank, Dr. Richard Winterhalter, Dr. Geert Moortgat, Prof. Meinrat Andreae, Prof. Jos Lelieveld, Prof. Stephan Borrmann

Scientific publications and public outreach 2006:

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### **Refereed journal articles**

Please consult the sub-project's individual reports for details.

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