UP 14: Atmosphäre - Spurengase, Aerosole und Labormessungen

Zeit: Donnerstag 10:00–12:30 Raum: HS 5

UP 14.1 Do 10:00 HS 5

Wolkenkondenstationskeimmessungen an der Wolkenkammer und an der Zugspitze — •Katharina Weixler — Karlsruher Institut für Technologie, Karlsruhe, Deutschland

Wolkenkondensationskeime (CCN) spielen eine wichtige Rolle bei der Wechselwirkung zwischen Aerosol und Wolke. Sie sind der Anteil eines Aerosols, der zu Tropfen wachsen kann. Das Anwachsen eines Partikels zu einem Tropfen ist abhängig vom Durchmesser des trockenen Aerosols, der Übersättigung im umgebendem Luftpacket, sowie von der chemischen Zusammensetzung. Dies kann die Wolkenbildung und Wolkenentwicklung beeinflussen. Mit einem zweisäuligem CCN-Counter (CCNC) wurden sowohl Messungen im Labor an der Wolkenkammer, als auch auf der Umweltforschungsstation Schneefernerhaus an der Zugspitze, während der Kapagne ACRIDICON, durchgeführt. Dabei wurde am CCNC verscheidene Übersättigungen eingestellt und am differential mobility analyser (DMA) der Durchmesser. Die Gesamtaerosolkonzentration wurde mit einem condensation particle counter (CPC) gemessen. Durch die zwei Säulen konnte parallel mono- und polydisperse gemessen werden. Diese Messdaten wurde miteinander verglichen.

UP 14.2 Do 10:15 HS 5

Formvar replicas of atmospheric ice crystals studied with ESEM — •Alexei Kiselev[1], Martin Schnaiter[1], Paul Vochezer[1], and Carl Schmitt[2] — [1]Karlsruhe Institute of Technology, Institute for Meteorology und Climate Research — [2]National Center for Atmospheric Research, Boulder, Colorado

The method of ice crystal replication in Formvar (polyvinyl acetal resin) was introduced by Vincent Schaefer in 1941 [1]. At that time no aircraft based optical instrumentation was available to study the morphology of ice crystals. In spite of the rapid advance of the sophisticated particle probes, the formvar replication technique, applied in its very original form, turns out to be a valuable complimentary method for the ice crystal habit characterization. In this contribution we show what kind of information on the ice crystal morphology and residual particles can be obtained from the formvar replicas of ice particles originated in the AIDA cloud simulation chamber. We demonstrate how the replicas can be analyzed with a modern ESEM and microprobe techniques and compare the images of preserved ice crystals with the forward scattering patterns obtained by the Small Ice Detector, an aircraft optical probe used for the in situ measurements of ice in atmospheric clouds.

1. Schaefer, V. J.: A method for making snowflake replicas. Science, 93 (1941) pp.239-240.

Kaffeepause, 30 min

Hauptvortrag UP 14.3 Do 11:00 HS 5

The chemistry of sprites and related plasma processes in the middle atmosphere — •Holger Winkler — Institut für Umweltphysik, Universität Bremen

Transient luminous events (TLEs) are large scale electric discharges occurring between active thunderstorms and the ionosphere. The most famous TLEs are the so-called sprites in the mesosphere, but there are other types of TLEs such as halos, elves, (blue) jets, (blue) starters, and gigantic jets. The plasma processes in TLEs give rise to chemical disturbances; in particular they lead to a production of reactive nitrogen and hydrogen radicals as well as other species affecting ozone. We have developed a plasma chemistry model in order to study the impact of TLEs in detail. Here we give an overview of TLEs and present some recent model results. For the first time, we were able to study the ion chemistry of a daytime sprite streamer in a consistent way. The chemical impact of a daytime sprite is found to be significantly larger than that of a nighttime sprite, especially in the lower mesosphere. The model was also applied to blue jet events in the stratosphere for which there are no detailed studies so far. One issue in TLE modeling is the impact on longer and larger scales. In order to simulate the mixing of streamer gas with the ambient atmosphere, a chemistry and diffusion model has been coupled to the plasma chemistry model. This allows providing chemical TLE impacts for global scale atmospheric chemistry and transport models.

UP 14.4 Do 11:30 HS 5

Ice multiplication in freezing cloud droplets: Break-up — •Thomas Pander[1], Alexei Kiselev[2], and Thomas Leisner[2] — [1]Ruprecht-Karls-Universität Heidelberg — [2]Karlsruher Institut für Technologie

Clouds are important for earth's precipitation and radiation budget. One of the determining factors of the lifetime of a cold cloud is the occurrence of a glaciation process, during which supercooled droplets freeze and may precipitate once they*ve grown to sufficient size. During this presentation, we report high-speed video evidence of one phenomenon that facilitates the glaciation of a cloud, a so-called secondary ice process. During a freezing event of a cloud droplet, a solid ice shell grows around a partly liquid core and may shatter under the rising pressure in the core due to the expansion during the phase transfer. The ice particles are propelled away at high speeds and may then cause freezing in other cloud droplets. Dependence on temperature, particle size and droplet diameter is explored and a potential enhancement factor of the ice nucleation capability of aerosol particles is given.

UP 14.5 Do 11:45 HS 5

How to compare contact and immersion freezing — •Nadine Hoffmann, Daniel Rzesanke, Denis Duft, Alexei Kiselev, and Thomas Leisner — Institute for Meteorology and Climate Research Atmospheric Aerosol Research (IMK-AAF), Karlsruhe Institute of Technology (KIT), Germany

The contact freezing of supercooled cloud droplets is one of the potentially important and the least investigated heterogeneous mechanism of ice formation in the tropospheric clouds [1]. Until now, the more ice active properties of contact freezing are still an unsolved mystery. In the experimental setup we are able to study single water droplets levitated in a laminar flow of aerosol particles. The particles are acting as contact or immersion freezing nuclei. The scavenging efficiency is calculated theoretically with account for Coulomb attraction, drag force and induced dipole interaction between charged droplet and aerosol particles. By repeating the freezing experiment for a sufficient number of times we were able to reproduce the statistical freezing behavior of large ensembles of supercooled droplets. The resulting freezing curves have a special shape depending on the rates of contact and immersion freezing. It will be discussed how to compare contact and immersion freezing. [1] - K.C. Young, The role of contact nucleation in ice phase initiation in clouds, Journal of the Atmospheric Sciences 31, 1974

UP 14.6 Do 12:00 HS 5

Ground-based total column measurements of greenhouse gases on Ascension Island — •Sabrina Niebling and Dietrich Feist — Max Planck Institute for Biogeochemistry

Anthropogenic emissions of greenhouse gases like CO_2 and CH_4 are important drivers of changes in radiative forcing and therefore climate changes. However, there remain still large uncertainties concerning the estimates of source and sink distributions of these gases to and from the atmosphere and more measurements are needed to adequately assess the problem. In 2004, the Total Carbon Column Observing Network (TCCON) was formed which consists of ground-based Fourier Transform Spectrometer (FTS) systems all around the world that provide high-resolution near-infrared spectral data . From these spectra, it is possible to retrieve total columns of CO_2, CH_4, CO and several other trace gases with very high precision. As part of the TCCON network we have deployed a mobile FTS system on Ascension Island (7.94° S, 14.37° W) in May 2012. We present first data from this very remote station and show a comparison of the measured ground-based total columns to other data sets such as ground-based in situ measurements and total column measurements retrieved from glint data acquired on board GOSAT.

UP 14.7 Do 12:15 HS 5

Horizontal and vertical distribution of bromine monoxide in northern Alaska during BROMEX (spring 2012) derived from airborne imaging-DOAS measurements — •Denis Pöhler[1], Stephan General[1], Johannes Zielcke[1], Paul B. Shepson[2], Holger Sihler[1], Udo Friess[1], Kerri A. Pratt[2], Steve Walsh[3], William R. Simpson[3], and Ulrich Platt[1] — [1]Institut für Umweltphysik, Uni Heidelberg, Germany — [2]Purdue University, West

Lafayette, USA — [3]Department of Chemistry and Biochemistry, University of Alaska Fairbanks, Fairbanks, AK

Bromine monoxide (BrO) is a reactive halogen species (RHS) and has been known for quite a while to have a profound impact on the chemistry of the polar tropospheric boundary layer. Details of the bromine release and reaction processes are still unclear, especially the role of different ice, atmospheric stability and aerosols. To investigate important details of the bromine release, a novel imaging DOAS instrument was deployed aboard a light twin-engine aircraft (ALAR, Purdue Univ.) as part of the BRomine, Ozone, and Mercury EXperiment (BROMEX) in Barrow, Alaska, in spring 2012. This instrument utilizes 1) a scanner system in nadir direction to map trace gas distributions of the overflown area at high spatial resolution and 2) a forward-looking system, to observe the vertical trace gas distribution of BrO and e.g. NO2. This was investigated over a wide variety of sea, ice and land surface conditions and observed a strong horizontal gradients of BrO within few km and a fast movement of BrO plumes. These and other results from 11 flights will be presented.