UP 4: Postersession Atmosphäre

Time: Wednesday 10:45–19:45 Location: G/Foyer

UP 4.1 Wed 10:45 G/Foyer

Tropical tropospheric ozone from satellite observations with the Convective Clouds Differential technique — •Elpida Leventidou, Kai-Uwe Eichmann, Mark Weber, and John Burrows — Institute of Environmental Physics, Bremen, Germany

Ozone influences most of the chemical reactions in the Troposphere. Its tropospheric abundance can be retrieved using space-borne observations of vertically integrated ozone and cloud heights. The Convective Clouds Differential (CCD) technique takes advantage of the frequent occurrence of convective clouds in the western Pacific region by subtracting above-cloud ozone of this region from clear-sky ozone elsewhere to derive global monthly mean tropospheric amount. An important assumption is that the above-cloud ozone in the western Pacific simulates the stratospheric ozone and that the stratospheric ozone field is invariant with longitude; which is approximately true in the tropics. A CCD algorithm has been developed and is applied to optical remote sensing observations from three satellite instruments, so that a unique long-term record of monthly averaged tropical (20S, 20N) tropospheric vertically integrated ozone (1995-2012) is created. First results of the CCD technique, including validation by comparisons with ozone data from ozonesondes, will be presented.

UP 4.2 Wed 10:45 G/Foyer

Reactive chlorine chemistry in the boundary layer of coastal Antarctica — •Johannes Zielcke[1], Denis Pöhler[1], Tim Hay[2], Udo Friess[1], Philipp Eger[1], Karin Kreher[2,3], and Ulrich Platt[1] — [1]Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany — [2]formerly: National Institute for Water and Atmospheric Research, Lauder, New Zealand — [3]Bodeker Scientific, Alexandra, New Zealand

A unique feature of the polar troposphere is the strong impact of halogen photochemistry, in which reactive halogen species are responsible for ozone depletion as well as the oxidation of elemental mercury and dimethyl sulphide. The source, however, as well as release and recycling mechanisms of these halogen species - for some species even abundances - are far from being completely known, especially of chlorine and iodine compounds. Here we present active long-path differential optical absorption spectroscopy (LP-DOAS) measurements conducted during austral spring 2012 at Ross Island, Antarctica, observing several species (BrO, O3, NO2, IO, ClO, OBrO, OClO, OIO, I2, CHOCHO, HCHO, HONO). For the first time, ClO was detected and quantified in the marine boundary layer of coastal Antarctica, with typical mixing ratios around 20 pptv and maxima around 50 pptv. Meteorological controls on the mixing ratio of ClO as well as the interplay with other halogen compounds will be discussed, such as the lack of observed OClO ($<$ 1 pptv). The results seem to reflect previously in chamber studies observed dependences on ozone levels and solar irradiance.

UP 4.3 Wed 10:45 G/Foyer

Characterizing variability in OH * emission altitudes during the last solar cycle retrieved from SCIAMACHY nightglow observations — •Georg Teiser[1], Christian von Savigny[1], and Holger Winkler[2] — [1]Institute of Physics, Ernst-Moritz-Arndt-Universität Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald — [2]Institute of Environmental Physics, University of Bremen, Otto-Hahn-Allee 1, 28359 Bremen

Hydroxyl nightglow observations are a fundamental tool to study the mesosphere. In particular the knowledge of the spatial and temporal variability of the OH* nightglow emission altitude is of importance for the interpretation of ground-based OH temperature measurements. In this context the OH* nightglow data set from SCIAMACHY (Scanning Imaging Absorption spectrometer for Atmospheric CHartographY) on Envisat (from August 2002 to December 2012) is analyzed for 11-year solar cycle signatures and short-term variability, e.g. solar-driven 27-day cycle and QBO (Quasi-Biennial Oscillation) signatures in vertical volume emission rate profiles and mean emission altitude of the OH(3*1) Meinel emission near the mesopause. Additionally, first results of investigation of the effect of SPEs (solar proton events) on the OH Meinel emission altitude and the comparison with simulations using the UBIC (University of Bremen Ion Chemistry) model are presented.

UP 4.4 Wed 10:45 G/Foyer

Aircraft-borne DOAS limb observations of UV/visible absorbing trace gas species over Borneo — •Katja Grossmann[1], Marcel Dorf[2], Bodo Werner[1], and Klaus Pfeilsticker[1] — [1]Institute of Environmental Physics, Heidelberg, Germany — [2]Max Planck Institute for Chemistry, Mainz, Germany

Airborne spectroscopic measurements were carried out aboard the research aircraft DLR-Falcon during the SHIVA campaign at Malaysian Borneo in November and December 2011 to study the abundance and transport of trace gases in the lower atmosphere. The measurements were evaluated using the DOAS technique in limb geometry, which supports observations of UV/visible absorbing trace gases. Vertical profiles of IO were inferred with maximum mixing ratios of 0.5-1.5 ppt close to its source region in the marine boundary layer. Enhanced IO concentrations occasionally occurred in the mid-troposphere, suggesting rapid vertical transport by shallow to medium strong convection. BrO did not exceed the detection limit since in the terrestrial tropical atmosphere around Borneo the chemistry of volatile organic compounds (VOCs) acts as a large sink for reactive bromine species. Frequently enhanced concentrations of HCHO and CHOCHO indicate efficient VOC photochemistry around Borneo since they are mainly produced through the oxidation of VOCs emitted from the tropical rain forest and from distinct anthropogenic sources. Signatures of HONO, HCHO, and NO_2 in the outflow of convective clouds suggest a rapid transport of HCHO and NO_2 from polluted near surface air into the upper troposphere as well as lightning-induced production of HONO and NO_x.

UP 4.5 Wed 10:45 G/Foyer

Spectroscopic measurements in the tropical tropopause layer from aboard the NASA Global Hawk — J. Stutz[1], M. Spolaor[1], J. Festa[1], F. Colosimo[1], B. Werner[2], R. Raecke[1,2], •L. Scalone[2], K. Pfeilsticker[2], M. Chipperfield[3], and R. Hossaini[3] — [1]Department of Atmospheric and Oceanic Science, UCLA, Los Angeles, USA — [2]IUP, University of Heidelberg, Heidelberg, Germany — [3]Institute for Climate and Atmospheric Science, SEE, University of Leeds, Leeds, UK

The Nasa initiated ATTREX (Airborne Tropical TRopopause EXperiment) project aims to answer relevant scientific questions such as the photochemistry, the micro-physics of aerosols and cloud particles, and air mass transport into and within the tropical tropopause layer (TTL). Within the ATTREX project, DOAS measurements were performed, using a 3 channel (UV/vis/near-IR) optical spectrometer. The DOAS measurements aim to measure the vertical profiles of Ozone relevant species in the TTL, such as O3, NO2, O4, BrO, IO and H2O, the liquid and ice water paths as well as some micro-physical properties of aerosols and clouds. Here an overview of the data is presented which were collected during the two field campaigns led from Edwards Air Force Base (EAFB) and Guam into the Eastern and Western Pacific. In particular we focus on the BrO and IO spectral retrieval which are interpreted using the radiative transfer model McArtim and predictions based on the photochemical fields simulated by SLIMCAT model. From the data new insights will be obtained into the photochemistry of halogen oxides in the TTL.

UP 4.6 Wed 10:45 G/Foyer

MAX-DOAS observation of CHOCHO, HCHO and NO2 over Nairobi and Athens — •Leonardo Alvarado[1], Andreas Richter[1], Enno Peters[1], Folkard Wittrock[1], John P. Burrows[1], Mihalis Vrekoussis[2], Myrto Gratsea[3], and Evangelos Gerasopoulos[3] — [1]Institute of Environmental Physics, University of Bremen, Bremen, Germany — [2]Energy, Environment and Water Research Center, The Cyprus Institute, Nicosia, Cyprus — [3]Institute for Environmental Research and Sustainable Development, National Observatory of Athens, Athens, Greece

Glyoxal (CHOCHO) and formaldehyde (HCHO) are intermediate products in the oxidation of most volatile organic compounds (VOCs) in the atmosphere. They therefore can be used as tracers of VOC concentrations in the atmosphere.

Nitrogen dioxide (NO2) plays an important role in tropospheric ozone formation in combination with VOCs, and is mainly emitted by anthropogenic activities. While sources and chemistry of CHOCHO

and HCHO are similar in many respects, the variation in production efficiency for different sources can be used to better constrain source attribution of VOCs.

In this study, we report time series of CHOCHO, HCHO, and NO2 vertical columns from MAX-DOAS measurements taken in Nairobi (2011-2013) and Athens (2013-2014), which are part of the BREDON network. The results show maxima for Jun-Jul-Aug and minima for Dec-Jan-Feb. Moreover, a significant increase of CHOCHO levels in Nairobi is observed for 2013 in comparison of the other two years.

UP 4.7 Wed 10:45 G/Foyer

Simultaneous balloon-borne measurements of the key inorganic bromine species BrO and $BrONO_2$ in the stratosphere: (DOAS evaluation) — •S. Kazarski[1,3], G. Maucher[1], A. Ebersoldt[2], A. Butz[1], H. Oelhaf[1], F. Friedl-Vallon[1], H. Nordmeyer[1], M. Hoepfner[1], S. Schmitt[3], L. Scalone[3], K. Grossmann[3], T. Hueneke[3], K. Pfeilsticker[3], and J. Orphal[1] — [1]IMK, Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]IPE, Karlsruhe Institute of Technology, Karlsruhe, Germany — [3]IUP, University of Heidelberg, Heidelberg, Germany

Inorganic bromine contributes to a loss of stratospheric ozone of about 25 - 30%. Past studies have demonstrated several uncertainties in the photochemistry of stratospheric bromine, especially by considering the three body reaction (k_{BrONO_2}) $BrO + NO_2 + M \rightarrow BrONO_2 + M$, and the photolysis frequencies of $BrONO_2$ (j_{BrONO_2}). Hence, an improved knowledge of the ratio j_{BrONO_2}/k_{BrONO_2} is crucial to better assess the bromine-related loss of ozone as well as the total amount of bromine in the stratosphere. Here, we report on the first simultaneous balloon-borne measurements of NO_2, BrO, and $BrONO_2$ in the stratosphere, performed over Timmins (Ontario)/Northern Canada on Sept., 7^{th} and 8^{th}, 2014. During the flight the targeted species NO_2 and BrO were monitored by remote sensing in the UV and visible spectral ranges by Differential Optical Absorption Spectroscopy (DOAS). The analysis and interpretation of the measurements involves radiative transfer as well as photochemical modelling. Major features of the applied techniques are reported and first results are discussed.

UP 4.8 Wed 10:45 G/Foyer

Simultaneous balloon-borne measurements of the key inorganic bromine species BrO and BrONO2 in the stratosphere: MIPAS evaluation — •Gerald Wetzel[1], Hermann Oelhaf[1], Felix Friedl-Vallon[1], Andreas Ebersoldt[2], Thomas Gulde[1], Michael Höpfner[1], Anne Kleinert[1], Guido Maucher[1], Hans Nordmeyer[1], and Johannes Orphal[1] — [1]Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research, Karlsruhe, Germany — [2]Karlsruhe Institute of Technology, Institute for Data Processing and Electronics, Karlsruhe, Germany

Despite being much less abundant, the contribution of bromine to stratospheric ozone depletion is similar to that of chlorine. The two major inorganic bromine species in the lower stratosphere are bromine oxide (BrO) and bromine nitrate (BrONO2). While BrO has first been observed around 20 years ago, BrONO2 has been detected by satellite limb observations in the mid-infrared spectral region only recently (in 2008). Dedicated to the simultaneous observation of BrO and BrONO2 including their diurnal variability, a balloon campaign took place from Timmins, Canada in September 2014. The remote sounding instrumentation consisted of three spectrometers covering the UV-VIS, the mid-infrared and the microwave spectral region. In this contribution we present the first results from the Michelson Interferometer for Passive Atmospheric Sounding Balloon-borne version 2 (MIPAS-B2): time- and height-dependent distributions of BrONO2 and NO2 volume mixing ratios together with a comprehensive error estimation and further diagnostic parameters of the inversion procedure.

UP 4.9 Wed 10:45 G/Foyer

Monitoring shipping emissions with MAX-DOAS measurements of reactive trace gases — •André Seyler[1], Folkard Wittrock[1], Lisa Kattner[1,2], Barbara Mathieu-Üffing[1,2], Enno Peters[1], Andreas Richter[1], Stefan Schmolke[2], Norbert Theobald[2], and John P. Burrows[1] — [1]Institute of Environmental Physics (IUP), University of Bremen — [2]Federal Maritime and Hydrographic Agency (BSH), Hamburg

The project MeSMarT (Measurements of shipping emissions in the marine troposphere, www.mesmart.de) has been established as a cooperation between the University of Bremen and the German Bundesamt für Seeschifffahrt und Hydrographie (Federal Maritime and Hydrographic Agency) with support of the Helmholtz Research Centre Geesthacht to estimate the influence of ship emissions on the atmospheric boundary layer and to establish a monitoring system for main shipping routes.

On the 1st of January 2015, the allowed sulfur content of marine fuels inside Sulfur Emission Control Areas (SECA) established by the International Maritime Organisation (IMO) has been significantly decreased from 1.0% to 0.1%.

Here we present MAX-DOAS observations of NO_2 and SO_2 carried out from two permanent sites close to the Elbe river (Wedel, Germany) and on the island Neuwerk close to the mouths of Elbe and Weser since the year 2013. Mixing ratios of both trace gases have been retrieved using different approaches (pure geometric and taking into account the radiative transfer) and compared to in situ observations. Furthermore, emission factors of NO_x and SO_2 have been calculated for single ships.

UP 4.10 Wed 10:45 G/Foyer

Airborne imaging DOAS during AROMAT — •Andreas C. Meier[1], Anja Schönhardt[1], André Seyler[1], Andreas Richter[1], Thomas Ruthz[2], and John P. Burrows[1] — [1]Uni Bremen, Institute of Environmental Physics — [2]FU Berlin, Institute for Space Sciences

The AROMAT campaign (Airborne Romanian Measurements of Aerosols and Trace Gases) was carried out in September 2014 as part of the preparations for the space-borne Sentinel-5 Precursor air-quality monitoring mission.

The IUP-Bremen contributed to this campaign with its imaging DOAS instrument, AirMAP. This instruments allows the detection of column densities of trace gases under the aircraft at a high spatial resolution (30×80 m^2). Mapping patterns were flown over Bucharest, that provided coverage the whole city in approx. 2.5h. These measurements show the spatial distribution of NO_2 column densities below the aircraft and show huge amounts of NO_2 inside the city centre and a strong gradient towards more rural areas.

UP 4.11 Wed 10:45 G/Foyer

Information content of tropospheric NO_2 measurements from space — •Andreas Hilboll, Andreas Richter, and John P. Burrows — Institut für Umweltphysik, Universität Bremen, Deutschland

In atmospheric pollution research, nitrogen dioxide (NO_2) is a commonly investigated trace gas. NO_2 vertical columns are routinely measured by several of today's satellite-based spectrometers. They can be useful for the identification and evaluation of natural and anthropogenic NO_x emissions and their changes over time.

One major drawback of the commonly used DOAS retrievals of NO_2 columns from satellite is the lack of vertical resolution. Combined with the altitude-dependence of retrieval sensitivity, this entails the use of a priori information on the NO_2 vertical profile, significantly contributing to the retrieval uncertainties. If information on the vertical location of the NO_2 could be retrieved from the measurements themselves, one could deduce surface mixing ratios, and the column uncertainties could be significantly reduced.

In this study, we investigate the vertical information content of nadir NO_2 observations in the UV/visible wavelength range. For this purpose, we investigate the information content of the radiances, to show how many independent pieces of information can be extracted from the masurements. We present the so-called information spectrum for the NO_2 profile inversion, showing the amount of information contained in the measured spectra at each wavelength, which will aid in an optimal selection of wavelengths for the profile retrieval.

UP 4.12 Wed 10:45 G/Foyer

Sensitivity of equatorial atomic oxygen in the MLT to the 11-year and 27-day cycles of solar activity — •Olexandr Lednyts'kyy and Christian von Savigny — Ernst-Moritz-Arndt-University of Greifswald, Greifswald, Germany

Atomic oxygen concentration ([O]) profiles are retrieved from O(^{1}S-^{1}D) nightglow emission rates provided by SCIAMACHY (SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY) on Envisat from August 2002 to April 2012 daily at approximately 22:00 local solar time. These O retrievals are used to assess the sensitivity of O in the mesosphere-lower thermosphere (MLT) region to the 11-year and 27-day solar activity cycles. The 11-year and 27-day solar cycle responses in SCIAMACHY O are statistically significant and of the same order. Our results correspond well to the 11-year solar cycle response in O volume mixing ratios found in simulations with the NCAR Whole Atmosphere Community Climate Model, version 3 (WACCM3), and the three-dimensional Hamburg Model of the Neutral and Ionized Atmosphere (HAMMONIA) model. Solar forcing causes

increased photodissociation of O_2 and raises the O abundance consequently.

UP 4.13 Wed 10:45 G/Foyer

Activities and Trace Gas Analyses at the central Flask and Calibration Laboratory for the ICOS network — Maria Büttner, Bert Steinberg, Michael Hielscher, Adam Janoschka, Markus Eritt, Christian Luetz, Rico Hengst, Michael Kuenast, •Daniel Rzesanke, and Armin Jordan — MPI f. Biogeochemistry, ICOS-Central Flask and Calibration Laboratory, Kahlaische Str. 4, 07745 Jena/Germany

The Integrated Carbon Observation System (ICOS) is an European-wide research infrastructure that aims at providing high quality observational data for the long-term monitoring of the European greenhouse gases balance. In the last two years a central facility of this network has been established. In summer 2014, the (central) Flask and Calibration Laboratory (FCL) in Jena started operation. Major tasks of this facility are the high accuracy measurements of ICOS relevant trace gases, namely CO2, CH4, CO, N2O, as well as SF6 and H2, the analysis of stable isotopes of CO2, CH4 and the O2/N2 ratio from flask air samples and the provision of calibrated reference gases for the networks in-situ stations. This last function assures network conformance to primary scale. Therefore, the FCL holds a large set of WMO reference standards to link to the respective scale. The laboratory has different internal and external quality assurance activities like i.e. round robin intercomparisons to help maintaining the desired precision.

In our contribution we will give an overview of the achieved performances as far as the facility's activities in providing and supporting high accuracy trace gas measurements.

UP 4.14 Wed 10:45 G/Foyer

Observations of RHS concentrations and processes at the Dead Sea Valley — •Stefan Schmitt[1], Robert Holla[1,2], Denis Pöhler[1], Udo Friess[1], Ulrich Platt[1], Andreas Held[3], Katharina Kamilli[3], Ulrich Corsmeier[5], and Jutta Zingler[4] — [1]IUP, Heidelberg — [2]Deutscher Wetterdienst — [3]BayCEER, Bayreuth — [4]FTU, Karlsruher Institut für Technologie — [5]IMK, Karlsruher Institut für Technologie

The Dead Sea Valley (DSV), located at the border of Israel and Jordan, is a unique place with high activity of reactive halogen species (RHS). Former DOAS measurements revealed high abundances of bromine monoxide (BrO) as well as iodine monoxide (IO) but the processes and sources are still not understood. Therefore we performed intensive LP-DOAS measurements in May 2012. We observed mixing ratios of up to 90 ppt, 5ppt and 60 ppt for BrO, IO and I_2 respectively. NO_2 mixing ratios dropped from about 6 ppb to below the detection limit of 0,5 ppb during sunrise on every day while significant BrO and IO concentrations were only detected at low NO_2 mixing ratios. This supports the assumption that NO_2 is consumed by the formation of $BrONO_2$ and $IONO_2$ from released RHS. The data shows several interesting chemical features which are presented.

Further, condensation particle counter (CPC) measurements of particles with sizes of 9-800 nm indicate that significant mixing ratios of IO were observed only at low particle loads while BrO seems to prefer high particle concentrations. This indicates a possible influence of aerosols on the halogen chemistry at the DSV.

UP 4.15 Wed 10:45 G/Foyer

Detection of noctilucent clouds in SCIAMACHY/Envisat nadir UV-measurements — •Martin Langowski and Christian von Savigny — EMAU Greifswald

The polar summer mesopause is the coldest region in the Earth's atmosphere and yields favorable conditions for cloud formation during three summer months and >50 deg. latitude. These clouds are called noctilucent clouds NLC, as through their high altitude of 82-88 km they are still illuminated several hours after/before sunset/sunrise.

Long term studies from SBUV satellite nadir measurements, e.g. DeLand et. al. (2007) and Shettle et. al. (2009), show an 11 years cycle for the occurence frequency of NLC as well as an long-term increase. The long term increase is not seen in other studies of the same dataset (e.g. Stevens et. al. 2007), in which the data is filtered for only certain local times.

Currently a new algorithm for the GOME, SCIAMACHY and GOME-2 instruments is being developed to extend the NLC data from nadir measurements. We will present this algorithm and show first results.

UP 4.16 Wed 10:45 G/Foyer

Mie resonance spectroscopy of levitated ternary organic/ammonium sulfate (AS)/water aerosol particles — •Andreas Peckhaus[1] and Ulrich Krieger[2] — [1]Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland — [2]Institut für Atmosphäre und Klima (IAC), ETH Zürich, Schweiz

The occurrence of liquid-liquid phase separation (LLPS) in internally mixed ternary C6/AS/H2O aerosol droplets levitated in an electrodynamic balance (EDB) is presented. The analysis of high resolution elastic Mie resonance spectra allowed the detection of LLPS and further changes in morphology within the aerosol particle. The influence of temperature and size on LLPS are discussed and compared with available literature. Bulk measurements of the refractive index, density and water activity of binary systems (C6/H2O and AS/H2O) and the ternary system (C6/AS/H2O, OIR = 0.5) are reported. From the Mie resonance spectra of these systems, refractive index, density and volume ratio can be retrieved. The obtained thermodynamic data expand the bulk measurements over a wider concentration range and can be used to calculate Mie resonance spectra for different morphologies (core-shell or partially engulfed configurations) and relative humidities. By comparison with the experimental spectra, conclusions can be drawn regarding the morphology of the phase separated aerosol.

UP 4.17 Wed 10:45 G/Foyer

Messung von Iodoxid in der Grenzschicht des indischen Ozeans mit CE-DOAS — •Henning Finkenzeller, Johannes Lampel, Denis Pöhler und Ulrich Platt — Institut für Umweltphysik, Universität Heidelberg

Auf der Schiffskampagne SO235 im tropischen indischen Ozean wurde Open-Path-Cavity-Enhanced-Differential-Optical-Absorption-Spectroscopy (Open Path CE-DOAS) zur berührungslosen in-situ Messung von Spurengasen in der marinen Grenzschicht betrieben. Im optischen Resonator wurden Lichtwege von ∼5 km im Spektralbereich von 420 - 450 nm realisiert; zur Senkung der Nachweisgrenzen wurden neue Ansätze im Messalgorithmus verfolgt um die Konzentrationsbestimmung von Iodoxid (IO), Glyoxal (CHOCHO), Stickstoffdioxid (NO_2), und Wasserdampf weiter zu verbessern.

Die vorläufige Auswertung bestimmt IO- und Glyoxal-Mischungsverhältnisse mit einer Nachweisgrenze von etwa 0,4 pptv und 60 pptv (parts per trillion volume). Innerhalb dieses Unsicherheitsbereichs wurde kein signifikanter Tagesgang von IO und Glyoxal beobachtet; deren Konzentrationen waren während SO235 niedriger als erwartet.

Typische NO_2-Mischungsverhältnisse lagen im Bereich von 0-200 pptv. Erhöhte NO_2-Konzentrationen (15 min Nachweisgrenze 40 pptv) können als Indikator für die Kontamination durch Abgase des eigenen Schiffes oder naher Schiffe interpretiert werden und stellen wichtige Zusatzinformationen bei der Interpretation anderer auf dem Schiff gewonnenener Luftmesswerte dar.

UP 4.18 Wed 10:45 G/Foyer

Aerosoldaten aus SCIAMACHY Sonnenokultationsmessungen — •Jacob Zalach und Christian von Savigny — Institut für Physik, Ernst-Moritz-Arndt-Universität, Greifswald

Transmissionsmessungen der Atmosphäre liefern Informationen über ihre Beschaffenheit und erlauben die Bestimmung der Verteilung ihrer Bestandteile. Im Rahmen des ROMIC-ROSA Projektes sollen stratosphärische Aerosolextinktionsprofile und ihre Teilchengrößenverteilung ermittelt werden.

Eine etablierte Methode stellten dabei satellitengestützte Okkultationsmessungen dar. Die Sonnenokkultationsmessungen des SCIAMACHY-Spektrometers (EnviSat) erstrecken sich über einen Zeitraum von zehn Jahren und decken den Wellenlängenbereich von 240 bis 2380 nm ab. Sie wurden bisher noch nicht vollständig ausgewertet. Eine direkte Übernahme existierender Auswerteverfahren ist zum großen Teil nicht möglich, vor allem wegen der geringeren Abtastrate der Messungen.

Der Beitrag zeigt die mit neu entwickelten bzw. angepassten Algorithmen gewonnenen Dichteverteilungen von O3, NO2 und insbesondere der Aerosole, die mit SAGE II Messungen als Referenz verglichen werden.

UP 4.19 Wed 10:45 G/Foyer

Different dusts in AIDA cloud chamber immersion freezing and deposition ice nucleation experiments — •Romy Ullrich, Naruki Hiranuma, Corinna Hoose, Ottmar Möhler, Monika Niemand, Isabelle Steinke, and Robert Wagner — Karlsruher

Institut für Technologie, Karlsruhe, Deutschland

Aerosols are defined as liquid or solid suspended particles in air. Their diverse composition and different sources impede a uniform handling regarding their ice nucleating ability and efficiency. Model studies, in-situ measurements as well as laboratory studies point out the importance of natural dust for heterogeneous ice nucleation. The variety of dust species shows the importance of the source and chemical features for forming ice by heterogeneous nucleation. The AIDA (Aerosol Interactions and Dynamics in the Atmosphere) cloud chamber was used for a series of ice nucleation experiments with among others different natural dust species to investigate the different ice nucleating behavior. These studies result in a comprehensive overview of the ice nucleation efficiency as a function of aerosol, temperature and humidity.

This conference contribution will show recent findings from the AIDA cloud chamber for different dust species including desert dust, soil dust, different clay minerals and volcanic ash particles (Steinke et al. (2011)). Additionally, a comparison of the different dust species regarding ice activity and possible reasons for deviations will be presented.

Steinke, I. (2011) Atmos. Chem. Phys., 11, 12945-12958

UP 4.20 Wed 10:45 G/Foyer

Aerosol measurements during the SOPRAN experiment in the Heidelberg Aeolotron — •Manuela van Pinxteren[1], Juan Najera[2], Badr R'Mili[3], Kerstin Krall[4], Gordon McFiggans[2], Barbara D'Anna[3], Bernd Jähne[4], and Hartmurt Herrmann[1] — [1]TROPOS Leipzig — [2]University of Manchester — [3]IRCELYON-CNRS-Univ. Lyon — [4]IUP University of Heidelberg

During the SOPRAN laboratory experiment in Heidelberg in November 2014, the annular wind-wave tank Aeolotron was filled with seawater from the Atlantic Ocean to study exchange processes between ocean and atmosphere. Besides gas exchange measurements, aerosol particles were sampled with different techniques in order to investigate to what extent organic material from the sea surface micro layer is transported into the aerosol particles. Aerosol particles were sampled on different filter materials and investigated for the total organic content and for different groups of organic compounds. Additionally the physical nature of the marine aerosols generated from seawater was characterize using continuously online sampling with an Scanning Mobility Particle Sizer coupled to a Condensation Particle Counter, and a Droplet Measurement Technologies-Cloud Condensation Nucleus counter. Finally, a MPS (mini-particle sampler) was applied which is a particle collection technique based on filtration on TEM porous grids. Further Transmission Electron Microscopy analysis will give information on size, morphology and elemental composition of the deposited particles. Here, the set up of the experiments and first preliminary results are presented.

UP 4.21 Wed 10:45 G/Foyer

A novel experimental setup to study heterogeneous nucleation and growth rates on meteor smoke particle analogues — •Mario Nachbar[1], Denis Duft[2], and Thomas Leisner[1,2] — [1]University of Heidelberg, IUP, Germany — [2]Karlsruhe Institute of Technology - IMK-AAF, Germany

Noctilucent clouds (NLC) have been detected in the polar summer mesopause region of Earth at heights of 80-90 km. These clouds are believed to be caused by heterogeneous nucleation of H2O on meteoric smoke particles (MSP). Surprisingly, similar clouds have been detected in the mesosphere of Mars as well. In contrast to NLCs on Earth, they consist of CO2 particles and occur at subtropical latitudes mostly during post aphelion season. Scientist dealing with the formation of NLCs struggle with large uncertainties in describing the nucleation processes taking place due to a lack of experimental data at the extreme mesospheric conditions which states the need of laboratory measurements. We recently designed a new linear ion trap which allows us to trap nanoscale particles under controlled temperature as well as H2O and CO2 concentration. We produce charged nanometer sized MSP analogues in a microwave resonator and transfer them to the ion trap held under typical mesospheric conditions. Heterogeneous ice nucleation and growth processes then can be examined by analyzing the mass distribution of the particles with a time-of-flight mass spectrometer as function of the residence time under supersaturated conditions. In this paper, the experimental setup and data analysis is exemplified with experiments on CO2 nucleation in the Martian mesosphere.

UP 4.22 Wed 10:45 G/Foyer

Preliminary results of the SOPRAN seawater gas exchange experiment in the Heidelberg Aeolotron — •Kerstin E. Krall[1], Jakob Kunz[1], Maximilian Bopp[1], Daniel Kiefhaber[1], Mariana Ribas Ribas[2], Janina Rahlff[2], Cuici Sun[3], Martin Sperling[3], Anke C. Nölscher[4], Bettina Derstroff[4], Christof Stönner[4], Bernd Schneider[5], Oliver Wurl[2], Anja Engel[3], Jonathan Williams[4], and Bernd Jähne[1,6] — [1]IUP, Universität Heidelberg — [2]ICBM, Universität Oldenburg — [3]GEOMAR, Kiel — [4]MPIC, Mainz — [5]IOW, Warnemünde — [6]HCI am IWR, Universität Heidelberg

In November 2014, air-sea gas exchange measurements using natural seawater were performed at the large annular wind-wave tank, the Aeolotron, within the BMBF SOPRAN project. Gas exchange velocities of a large number of trace gases (e.g. He, Xe, Kr, SF_6, CO_2, N_2O), volatile chemical species (e.g. DMS, acetone, acetonitrile, methanol) and heat, covering the whole range of solubility and diffusivity, were measured. Measuring techniques were LI-COR, FT-IR spectroscopy, MIMS, PTR-MS, and active thermography. Temperatures, water and wind velocities and wind waves were monitored as well. Eleven wind speeds ranging from 1.4 to over 10 m/s were used. An aerator was used to simulate strong breaking waves with bubble entrainment and spray formation. One goal of the experiment was to study the effects of natural surfactants present in the sea surface micro layer, which dampen waves and reduce gas transfer. This poster presents the setup of the experiment and discusses first preliminary results.

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Ice crystal growing on mineral surfaces in ESEM — •Felix Bachmann[1], Alexei Kiselev[1], Philipp Pedevilla[2], Stephen Cox[2], and Angelos Michaelisdes[2] — [1]Atmospheric Aerosol Research Department, Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]London Centre for Nanotechnology, University College London, London, UK

Observing deposition growth of ice crystals in an Environmental Scanning Electron Microscope (ESEM, FEI Quanta 650 FEG), we noticed that the ice crystals often have identical orientation of both basal and prism faces, and are tilted at a universal angle of 116° to the surface of the mineral substrate. To determine the range of conditions favoring such alignment, we have tested temperatures from -25°C to -50°C with freshly cleaved and weathered mineral surfaces. These experiments have been realized with our self-build humidity control system which allowed us to control partial water vapor pressure in the ESEM chamber. Alignment of crystals requires that the c-axis of both ice and microcline crystal lattice have to be parallel but also means that the basal (001) planes of ice and microcline are mismatched. We report a gradual reduction of crystal alignment with decreasing temperature. We discuss a possible mechanism of crystal lattice alignment by considering a layer of ordered water on the surface of microcline forming prior to ice nucleation. Using DFT we show how the mineral surface interacts with water, particularly addressing the role of surface cations and hydroxyl groups in the arrangement of adsorbed water molecules.

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Forward scattering by levitated ice crystals — •Mohamed Abdelrasoul[1,2], Alexei Kiselev[2], and Thomas Leisner[2,3] — [1]Karlsruhe School of Optics and Photonics KSOP (KIT), Karlsruhe — [2]Institute for Meteorology and Climate Research (KIT), Karlsruhe — [3]Institute of Environmental Physics, University of Heidelberg

Ice clouds have a significant impact on the energy budget of the earth-atmosphere system, as solar and terrestrial radiation interacts with earth's atmosphere. Cirrus clouds are made of non-spherical ice crystals which can take on a variety of shapes, from regular habits such as plates, columns and bullet- rosettes, to irregular habits, the shape of ice crystals being determined by the temperature and pressure of water vapor in the vicinity of a growing or evaporating ice crystal. The radiative properties of ice clouds depend on the optical properties of ice crystals, which can be best studied under laboratory conditions. With this goal in mind, we have built an optical system allowing for measurements of the two dimensional forward scattering patterns of the ice crystals that are freely levitated in an electrodynamic balance (EDB) of a quadrupole type. The temperature and relative humidity inside the balance are controlled. High dynamic range CMOS camera is used to record the forward scattering by a single ice crystal illuminated with circularly polarized 532 nm laser beam. The recorded scattering patterns are analyzed for characteristic features of different crystal habits and surface morphology (smooth or rough).

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Studying Ice-crystallization on the Molecular Level using Nonlinear Optical Spectroscopy — •Ahmed Abdelmonem, Johannes Lützenkirchen, and Thomas Leisner — Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Heterogeneous ice formation on mineral surfaces is important for precipitation formation in mixed phase clouds and for the formation of cirrus clouds. It is not well understood which structural and chemical characteristics of ice nucleation surfaces and dissolved ions account for the variability in ice crystallization efficiency.

We apply Second Harmonic Generation (SHG) spectroscopy to monitor the evolution of water structuring at solid surfaces upon cooling down to the temperature of heterogeneous freezing. This method enables a direct discrimination between good and poor ice nucleating surfaces. In this presentation, we compare the evolutions of the freezing process of water on two different surfaces (sapphire and mica). In addition, a direct comparison between ice crystallization on sapphire surface in the presence and absence of dissolved salts is presented. While sapphire which is known as poor ice nucleator shows no influence on the structure of water molecules in contact with its surface upon cooling until the freezing point, mica which is one of the common ice nucleation atmospheric substances shows an increase in the local ordering of the first water layer in contact with the surface which is expected to facilitate and control the crystallization of ice at the surface.