Environmental Physics Division
Fachverband Umweltphysik (UP)

Justus Notholt
Institut für Umweltphysik
Universität Bremen
Otto-Hahn-Allee
28359 Bremen
notholt@uni-bremen.de

Ulrich Platt
Institut für Umweltphysik
Universität Heidelberg
Im Neuenheimer Feld 229
69120 Heidelberg
Ulrich.Platt@iup.uni-heidelberg.de

Übersicht der Hauptvorträge und Fachsitzungen

(Vorträge: H41; Poster: Foyer vor dem H41;
Abendvorträge: H1; Preisträgervortrag: H3;
Gemeinsame Veranstaltung mit dem AKE: H41)

Hauptvorträge

UP 1.1	Tue	10:15–10:45	H41	**Observations of tropospheric NO2 at different scales** — •Andreas Richter, Andreas Hilboll, Andreas C. Meier, Anja Schönhardt, Stefan F. Schreier, Enno Peters, Folkard Wittrock, John P. Burrows
UP 3.1	Tue	14:00–14:30	H41	**Nucleation, life cycle and climate impact of contrail cirrus - new insights** — •Christiane Voigt
UP 5.1	Wed	9:30–10:00	H41	**Globale Klimavariabilität im Industriezeitalter - Phänomene und Ursachen** — •Christian-Dietrich Schönwiese
UP 5.2	Wed	10:00–10:30	H41	**The 2°C climate policy goal: Chances & Challenges** — •Hermann Held
UP 5.3	Wed	10:30–11:00	H41	**How regional climate interacts with wind power generation** — •Robert Vautard
UP 5.4	Wed	11:00–11:30	H41	**Offshore-Windenergienutzung - Chancen, Herausforderungen und Auswirkungen aus meteorologischer Sicht** — •Stefan Emeis
UP 6.1	Wed	11:45–12:15	H41	**Estimating wind energy limits and atmospheric impacts at large scales from climate model simulations and first principles** — Lee Miller, •Axel Kleidon
UP 8.1	Wed	14:15–14:45	H41	**Niederschlagsmessung mit Richtfunkstrecken kommerzieller Mobilfunknetzwerke** — •Harald Kunstmann, Christian Chwala, Felix Keis
UP 11.1	Thu	10:00–10:30	H41	**Towards disentangling natural and anthropogenic CO2 and CH4 fluxes using space based measurements of XCO2 and XCH4** — •Heinrich Bovensmann, Michael Buchwitz, Konstantin Gerilowski, Sven Krautwurst, Thomas Krings, Maximilian Rauter, Oliver Schneising, Jens Heymann, John P. Burrows
UP 11.2	Thu	10:30–11:00	H41	**AIRCORE as a new tool to study stratospheric age of air** — •Andreas Engel, Harald Bönisch
UP 13.1	Thu	13:45–14:15	H41	**NO_2 Luftverschmutzung und Emissionen von Fahrzeugen unter realen Fahrbedingungen** — •Denis Pöhler, Florian Kanatschnig, Tobias Österle, Martin Horbanski, Axel Friedrich, Johannes Lampel, Ulrich Platt

Weitere Vorträge von Interesse für die Umweltphysik

PV VIII	Tue	13:15–13:45	H3	**Energie und Klima: Cool Facts for a Hot Debate ?** — •Christoph Buchal
PV XVIII	Wed	20:00–21:00	H1	**Vorhersagen sind schwierig ... Möglichkeiten und Grenzen von Klimamodellen** — •Jochem Marotzke
PV XXV	Thu	17:30–18:30	H1	**Lise-Meitner-Lecture: Ist Leben konstruierbar?** — •Petra Schwille

Fachsitzungen

UP 1.1–1.5	Tue	10:05–13:15	H41	**Atmosphere - Trace Gases**
UP 2.1–2.1	Tue	13:15–13:45	H3	**Preisträgervortrag von Prof. Buchal**
UP 3.1–3.6	Tue	14:00–15:45	H41	**Atmosphere - Aerosols**
UP 4.1–4.15	Tue	16:00–17:30	Foyer H41	**Poster Session**
UP 5.1–5.4	Wed	9:20–11:30	H41	**AKE und UP: Energiewende und Klimawandel**
UP 6.1–6.3	Wed	11:45–12:45	H41	**Additional Topics**
UP 7	Wed	12:45–14:15	H41	**Mitgliederversammlung**
UP 8.1–8.3	Wed	14:15–15:15	H41	**Hydrosphere, Soil and Agricultural Physics**
UP 9	Wed	15:15–17:15	Foyer H41	**Poster Session**
UP 10.1–10.1	Wed	20:00–21:00	H1	**Abendvortrag von Prof. Jochem Marotzke**
UP 11.1–11.2	Thu	10:00–11:15	H41	**Atmosphere - Trace Gases**
UP 12.1–12.4	Thu	11:15–13:45	H41	**Methods - Remote Sensing**
UP 13.1–13.1	Thu	13:45–14:15	H41	**Environmental Technology**
UP 14.1–14.2	Thu	14:15–15:15	H41	**Methods - Data evaluation and Modelling**
UP 15.1–15.3	Thu	15:15–16:00	H41	**Methods - Measurement Techniques**
UP 16.1–16.2	Thu	16:00–16:30	H41	**Atmosphere - Laboratory Studies**
UP 17.1–17.1	Thu	17:30–18:30	H1	**Abendvortrag von Prof. Petra Schwille**

Mitgliederversammlung des Fachverbands Umweltphysik

Mittwoch 12:45 - 14:15 H41
Mitgliederversammlung für alle Mitglieder des Fachverbandes mit Mittagsimbiss, Gäste willkommen

- Bericht über Aktuelles aus dem Fachverband
- Wahl eines neuen Vorsitzenden
- Pressemitteilung zur Physik des Klimas nach Paris (CoP21)
- Ausgestaltung der Zusammenarbeit mit DGG und DMG
- Verschiedenes, z.B. Kommentare und Anregungen der Teilnehmer

UP 1: Atmosphere - Trace Gases

Time: Tuesday 10:05–13:15 Location: H41

Begrüßung und Eröffnung (10:05 - 10:15)

Invited Talk UP 1.1 Tue 10:15 H41

Observations of tropospheric NO2 at different scales — •Andreas Richter, Andreas Hilboll, Andreas C. Meier, Anja Schönhardt, Stefan F. Schreier, Enno Peters, Folkard Wittrock, and John P. Burrows — Institut für Umweltphysik, Universität Bremen, Deutschland

Nitrogen oxides are important players in the chemistry of the atmosphere, both in the troposphere and the stratosphere. As they are emitted by many anthropogenic activities, they are often used as tracer of pollution. Having a short atmospheric life time, nitrogen oxides are mainly found close to their sources.

Nitrogen dioxide can be measured by UV/visible remote sensing from satellite, aircraft and from the ground. These different measurements average over different temporal and spatial scales, leading to different but complimentary views of the distribution of NO_2 in the polluted troposphere. Comparing and combining these data sources provides unique information on the variability of this species and what is needed for an observing system to obtain appropriate measurements to understand the behaviour of NO_2 in the troposphere.

In this presentation, satellite data from GOME2 and OMI will be linked to airborne high resolution NO_2 maps from the AirMap instrument, ground-based MAX-DOAS observations at multiple azimuth angles and car-DOAS measurements, all in polluted locations.

UP 1.2 Tue 10:45 H41

Variations of the BrO/SO_2 molar ratios during the 2015 Cotopaxi eruption — •F. Dinger[1,2], S. Arellano[3], J. Battaglia[4], N. Bobrowski[2,5], B. Galle[3], S. Hernandez[6], S. Hidalgo[6], C. Hörmann[1], P. Lübcke[2], U. Platt[2], M. Ruiz[6], S. Warnach[2], and T. Wagner[1,2] — [1]MPIC, Mainz, Germany — [2]IUP, University of Heidelberg, Germany — [3]Chalmers University of Technology, Gothenburg, Sweden — [4]LMV, Université Blaise Pascal-CNRS-IRD, France — [5]University of Mainz, Germany — [6]IGEPN, Quito, Ecuador

Cotopaxi volcano is located 50 km south of Quito, the capital of Ecuador. After almost 140 years of relative quiescence, increasing activity is observed in seismicity and gas emissions since May 2015. Since 2009 Cotopaxi volcano is part of the Network for Observation of Volcanic and Atmospheric Change (NOVAC) which regularly monitors the SO_2 emissions of more than 30 volcanoes using scanning UV-spectrometers. The interpretation of SO_2 emissions can be improved by additionally recording halogen/sulphur emission ratios. Recently, it has been shown that spectra from NOVAC instruments can also be used to retrieve the BrO/SO_2 molar ratio by applying Differential Optical Absorption Spectroscopy (DOAS). We apply DOAS to analyse the plume composition of Cotopaxi volcano and will present time series of the BrO/SO_2 molar ratios as monitored by the ground-based NOVAC instruments since March 2015. Prior to the phreatic explosions in August 2015 the BrO signal was below the detection limit. Soon after the explosions the BrO/SO_2 molar ratio was low as $1 \cdot 10^{-5}$, but during September-December 2015 this ratio varies between $3 - 11 \cdot 10^{-5}$.

Kaffeepause (30 min)

UP 1.3 Tue 11:30 H41

Effect of the solar proton events on the OH Meinel emission altitude and variability in Hydroxyl airglow 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 — [2]Institute of Environmental Physics, University of Bremen

Airglow observations are a fundamental tool to study the Earth's mesosphere. Today there is a network of ground-based instruments at locations distributed all over the world to observe the night time hydroxyl airglow in the mesopause region. In particular the emission of chemically excited OH molecules is used to derive the kinetic temperature in the height of ~87 km. In this context the knowledge of the spatial and temporal variability of the OH nightglow emission is of importance for the interpretation of ground-based OH temperature measurements. The OH nightglow data set from SCIAMACHY on Envisat (from August 2002 to April 2012) is analyzed for 11-year solar cycle signatures and short-term variability, e.g. solar-driven 27-day cycle and QBO signatures in vertical volume emission rate profiles and mean emission altitude of the OH(3-1) and OH(6-2) Meinel emission. Additionally, the effect of precipitating solar protons on the OH Meinel emission rate and emission altitude caused by ion-chemical processes is presented. SCIAMACHY measurements cover all major SPEs in the years 2003 to 2011. The observations are compared with simulations using the UBIC (University of Bremen Ion Chemistry) model.

UP 1.4 Tue 11:45 H41

Airglow von angeregten O2- und OH-Molekülen: Vergleich des Globalmodells EMAC mit SCIAMACHY Beobachtungen — •Stefan Versick[1], Stefan Bender[1], Christian von Savigny[2], Miriam Sinnhuber[1], Georg Teiser[2], Alexey Vlasov[1] und Amirmahdi Zarboo[1] — [1]Karlsruher Institut für Technologie, Deutschland — [2]Ernst-Moritz-Arndt-University Greifswald, Deutschland

Bei Airglow handelt es sich um eine schwache Leuchterscheinung in den oberen Schichten der Atmosphäre. Er wird durch verschiedene photochemische Prozesse verursacht. Airglow kann genutzt werden um Mischungsverhältnisse verschiedener Spurenstoffe zu bestimmen, um dynamische Phänomene zu untersuchen, oder um chemische Heizraten zu bestimmen. Hier konzentrieren wir uns auf den durch Chemolumineszenz und Photodissoziation von O3 angeregten Airglow von O2- und OH-Molekülen.

Für die gezeigten Vergleiche nutzen wir die neu entwickelte vertikal erweiterte EMAC-Version und um die relevanten Prozesse für Airglow erweitert wurde. Das online-gekoppelte Chemiemodell MECCA berechnet hieraus die Übergänge der angeregten OH-Moleküle. Dieser Vortrag konzentriert sich auf den OH(3-1) Übergang bei einer Wellenlänge von 1540 nm. Wir vergleichen die Modellergebnisse mit SCIAMACHY-Beobachtungen.

EMAC wurde ebenfalls um den Airglow von zwei angeregten Zuständen des molekularen Sauerstoffs erweitert: O2($^1\Delta$) bei 1270nm und O2($^1\Sigma$) bei 762nm. Wir zeigen Vergleiche mit den Ergebnissen des neuen Retrievals der 762nm-Bande aus SCIAMACHY-Beobachtungen.

UP 1.5 Tue 12:00 H41

First retrievals of Na profiles in the mesopause region based on Na nightglow observations — •Christian von Savigny, Bianca Zilker, and Martin Langowski — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald

The Na D lines are a well known feature of the terrestrial airglow and have been identified for the first time in 1929. During the daytime the Na airglow emission is caused by resonance fluorescence, while during the night the excitation occurs by chemiluminescent reactions. Knowledge of Na in the mesopause region is of interest, because the Na layer is thought to be maintained by meteoric ablation and Na measurements allow constraining the meteoric mass influx into the Earth system. In this contribution we employ SCIAMACHY/Envisat nighttime limb measurements of the Na D-line airglow from fall 2002 to spring 2012 - in combination with photochemical models - in order to retrieve Na concentration profiles in the 75 - 100 km altitude range. The Na profiles show realistic peak altitudes, number densities and seasonal variations. The retrieval scheme, sample results and comparisons to ground-based LIDAR measurements of Na as well as SCIAMACHY daytime retrievals will be presented. Moreover, uncertainties in the assumed photochemical scheme and their impact on the Na retrievals will be discussed.

Mittagspause (12:15 - 13:15)

UP 2: Preisträgervortrag von Prof. Buchal

Time: Tuesday 13:15–13:45 Location: H3

Prize Talk UP 2.1 Tue 13:15 H3

Energie und Klima: Cool Facts for a Hot Debate ? — •Christoph Buchal — Forschungszentrum Jülich und Universität zu Köln, D-52425 Jülich — Träger des Robert-Wichard-Pohl-Preises

Die gegenwärtige Diskussion um die Entwicklung des Klimas, um die energiebedingten Emissionen und um die Energiewende wird in der Öffentlichkeit, in den Medien und von der Politik mit großer Entschiedenheit, oft sogar mit unerbittlichem Sendungsbewusstsein geführt. Die gesicherte wissenschaftliche Faktenlage und die sehr komplexe globale Situation geraten dabei bisweilen aus dem Blick. Ein in zahlreichen Vorträgen praktizierter Ansatz zur Objektivierung der Diskussion mit Hilfe einer überzeugenden Hierarchie von Fakten wird vorgestellt. Auf diese Weise soll ein angstfreier, quantitativer und pragmatischer Umgang mit den Problemen und Erfolgen der Energieversorgung gefördert werden.

UP 3: Atmosphere - Aerosols

Time: Tuesday 14:00–15:45 Location: H41

Invited Talk UP 3.1 Tue 14:00 H41

Nucleation, life cycle and climate impact of contrail cirrus - new insights — •Christiane Voigt — Deutsches Zentrum für Luft- und Raumfahrt (DLR) — Johannes Gutenberg-Universität Mainz

Current growth rates in aviation demand a profound scientific data base in order to accurately assess the aviation impact on climate. A major contribution results from contrail cirrus and their radiative forcing is suggested to outbalance aviation CO2 and NOx effects. Direct observations of contrail cirrus throughout their life cycle are scarce and prone to substantial ambiguities currently limiting our understanding of the climate impact by aviation.

Here, we give new insights into the nucleation, growth, life cycle and climate impact from contrail cirrus based on results from suite of recent aircraft experiments. NASAs ACCESSII mission focusses on aircraft emissions and initial stages of contrail formation. Nascent contrails were detected at cruise altitudes near 100 m distance to the engine exit. Contrail growth to 10-min contrail age is investigated during DLRs CONCERT campaigns. Finally, the objective of the ML-CIRRUS experiment with the HALO research aircraft is to study the life cycle and climate impact of contrail cirrus with a novel in-situ/remote sensing payload. The contrail measurements are related to previous observations and discussed in the context of recent developments in contrail modeling. Highlights include the quantification of the effects of aircraft type, engine technology and alternative fuels on contrail microphysics and climate.

UP 3.2 Tue 14:30 H41

Studying the limitations of stratospheric aerosol injections using the IPSL climate model — •Christoph Kleinschmitt[1,2], Olivier Boucher[2], and Ulrich Platt[1] — [1]Institute of Environmental Physics, Heidelberg University, Germany — [2]Laboratoire de Météorologie Dynamique, Paris, France

Climate Engineering (CE) is currently being discussed as an option to prevent or at least reduce the magnitude of global warming. Basically there are two types of CE: 1) removing greenhouse gases (i.e. CO_2) from the atmosphere, 2) direct modifications of the Earth's radiation budget. Of the latter type stratospheric aerosol injection (SAI) in analogy to major volcanic eruptions is probably the most prominent of the proposed techniques. Numerous modeling studies on SAI and its effect on climate have been published during recent years (e.g. in the framework of the geoengineering model intercomparison project), mostly proving its power to reduce the global mean surface temperature significantly, but also revealing potential risks and undesirable side effects on the climate system.

For a robust estimate of the cooling potential of SAI we developed a 3D aerosol model with a sectional approach fully coupled to the radiative scheme and other aspects of the IPSL climate model. This allows us to study physical effects limiting the radiative forcing, such as absorption and reemission of infrared radiation, particle growth through condensation and coagulation and changes in particle lifetime due to transport within the stratosphere. Recent results of climate simulations under various SAI scenarios will be presented.

UP 3.3 Tue 14:45 H41

Potential ice multiplication mechanism associated with freezing of large drizzle droplets — •Annika Lauber, Mona Schätzle, Patricia Handmann, Thomas Pander, Alexei Kiselev, and Thomas Leisner — Atmospheric Aerosol Research Department, Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

At temperatures above -38°C freezing of a cloud droplet requires an ice nucleating particle (INP). However, at temperatures above -12°C ice particles have been found in concentrations exceeding the number of INPs by 10^4. A possible explanation for this discrepancy is the fragmentation of supercooled drizzle drops at freezing.

To investigate this process, we are observing levitated freezing droplets with a high-speed video camera (up to 200,000 fps). Records of more than 10,000 individual freezing events already allowed the identification of two potentially important ice multiplication pathways: the expulsion of bubbles during the ice shell formation and the fragmentation of a droplet due to the growth of internal pressure.

To explore the fragmentation of large freezing drops, we have modified our setup to allow levitation of water drops with diameters of up to 500 μm. Based on the former and recently obtained measurement data, we discuss the size and temperature dependence of the suggested ice multiplication mechanism and its potential implication for cloud microphysics.

UP 3.4 Tue 15:00 H41

Diesel vehicle generated nanoparticles with maximum lung intrusion efficiency: Formation, effects, and recent findings — •Frank Arnold[1,5], Liisa Pirjola[2,3], Topi Roenkoe[4], Ulrike Reichl[1], Hans Schlager[5], Tero Laehde[2,4], Jirki Heikkilae[4], and Jorma Keskinen[4] — [1]Max Planck Institute for Nuclear Physics (MPIK), Heidelberg, Germany — [2]Department of Technology, Metropolia University of Applied Sciences, Helsinki, Finland — [3]Department of Physics, University of Helsinki, Finland — [4]Aerosol Physics Laboratory, Department of Physics, Tampere University of Technology, P.O. Box 692, FIN-33101 Tampere, Finland — [5]Deutsches Zentrum fuer Luft und Raumfahrt (DLR), Oberpfaffenhofen, Germany

Modern Diesel vehicle exhaust after-treatment systems (ATS) can promote formation of low-vapor-pressure gases, which may undergo nucleation and condensation, leading to nucleation particles(NUP). NUP have diameters around 10-20 nm, which allow intrusion, with maximum efficiency, of the deepest and most vulnerable region of the hunman lung. Indications for adverse health effects of NUP have increased during recent time. However, NUP are presently not regulated by legislation. The chemical nature and formation mechanism of NUP are only poorly explored. Here, we present novel online measurements of NUP precursor gases and NUP, conducted in Diesel vehicle exhaust. We find that strong acids (particularly sulfuric acid and certain di-carboxylic acids)are efficient drivers of NUP formation and early growth. Interestingly, their formation is increased by modern Diesel exhaust aftertreatment systems. Diesel NUP deserve increased future attention.

UP 3.5 Tue 15:15 H41

Temperature-dependent formation of NaCl dihydrate in levitated sea salt aerosol particles — •Andreas Peckhaus, Alexei Kiselev, and Thomas Leisner — Karlsruher Institut für Technologie (KIT), Karlsruhe, Deutschland

The temperature-dependent formation of NaCl dihydrate in effloresc-ing pure NaCl solution droplets and synthetic sea salt aerosol (SSA) particles was investigated with an electrodynamic balance (EDB). A higher formation of NaCl dihydrate at warmer temperatures (>-20°C)

was obtained for SSA particles. A possible mechanism triggering the formation of NaCl dihydrate in SSA particles is discussed. Furthermore a comprehensive derivation of the temperature-dependent homogeneous nucleation rate coefficients for pure NaCl solution droplets is given and used to reconcile previous results.

UP 3.6 Tue 15:30 H41

Meteorology and ultrafine aerosols, an airborne study — •Wolfgang Junkermann — Karlsruhe Institut für Technologie, IMK-IFU

The horizontal and vertical distribution of aerosols in the lower troposphere and planetary boundary layer is affected by efficient transport and mixing processes. For example aerosol transport can be followed over several hundred km with small airborne platforms in case of well defined aerosol sources which increase the particle number concentrations significantly above typical background values. Such *plume* studies also allow compare with and to investigate the spatial and temporal patterns of particle number and size distributions as observed from ground based field studies. Airborne measurements using ultralight aircraft were performed all over Germany covering in situ fine and ultrafine particle size distributions and (micro)meteorological data. Based on in situ data and additional HYSPLIT backtrajectories major individual particle sources were identified and quantified and their impact on rural and urban environments on a regional scale downwind studied. The results are well in agreement with recent observations of aerosol spatial, temporal and size distributions in the ultrafine size spectrum and confirm the dominant role of meteorological processes on aerosols not only in the lower troposphere but also for ground level investigations.

UP 4: Poster Session

Time: Tuesday 16:00–17:30 Location: Foyer H41

UP 4.1 Tue 16:00 Foyer H41

Bestimmung der relevanten klimatologischen Parameter Offshore — •Jörg Bendfeld, Stefan Balluff und Stefan Krauter — Universität Paderborn, Paderborn, Deutschland

Zur Finanzierung von Offshore Windparkprojekten benötigen Projektentwickler verlässliche Daten über die vorherrschenden klimatologischen Verhältnisse für den jeweiligen Standort. Der gegenwärtige Ansatz besteht darin, einen Messmast am geplanten Standort zu errichten und über einen Zeitraum von mehreren Jahren zu betreiben. Diese Daten liefern dann die Grundlage für verschiedenste Aufgabenstellungen. Solche Messmasten werden mit einer Vielzahl von konventionellen Messgeräten bestückt, leider sind die Kosten (Planung, Errichtung und Betrieb) für ein solches Bauwerk sehr hoch (bis zu 10 Millionen Euro). Zum Vergleich wird die konventionelle Herangehensweise mit der eines schwimmenden Lidars (Light Detektion and Ranging) verglichen. Lidar-Systeme senden Laserpulse aus und detektieren das aus der Atmosphäre zurückgestreute Licht, daraus können Parameter wie die Windgeschwindigkeit und Windrichtung erfasst werden.

UP 4.2 Tue 16:00 Foyer H41

Systemvergleich zur zeitlich und örtlich hochaufgelösten Einstrahlungsmessung — •Jörg Bendfeld, Stefan Balluff, Stefan Krauter und Tobias Harst — Universität Paderborn, Paderborn, Deutschland

Die derzeit zur Messung der Solarstrahlung vorhandene Meßtechnik basiert fast ausnahmslos auf der definitionsgemäßen Einteilung in Global-, Diffus- und Direktstrahlung. Die hierzu am Markt verfügbaren Systeme sind in der Regel Individualmeßgeräte, die nur eine der drei Strahlungsgrößen erfassen. Da die Meßgeräte die einfallende Strahlung aus dem Himmelshalbraum aufintegrieren, ist keine Aussage über die Richtunsabhängigkeit der Solarstrahlung möglich. Der Systemvergleich zeigt die Vor- und Nachteile, sowie die Entwicklungsmöglichkeiten der Systeme: Solar-Igel I, Solar-Igel II und Skyscanner. Alle Systeme erlauben eine örtlich hochaufgelöste Einstrahlungsmessung, wobei die Systeme Solar-Igel II und Skyscanner mehr Freiheitsgrade bieten, als das statische Meßgerät zur differenzierten Erfassung der solaren Strahlung (Solar-Igel I).

UP 4.3 Tue 16:00 Foyer H41

Mean age of stratospheric air in the Bremen CTM — •Evgenia Galytska, René Hommel, and John P. Burrows — Institute of Environmental Physics, University of Bremen, DE

To analyse the variability and strengths of the Brewer-Dobson circulation (BDC), the mean age of air (AoA) conceptual model has been implemented in a 3D chemistry transport model (CTM), driven by ERA-INTERIM (EI) reanalysis. The concept defines idealized particles as time increments that accumulate during simulation depending on their transient time within the BDC. The resulting transient time (AoA) is investigated with respect to the initial time of the particle's release at the lower boundary.

We aim to understand possible changes in the transport characteristics of our CTM over the last 2.5 decades resulting from changes in model parametrizations for the treatment of advection, radiation, and chemistry. We relate our findings to the ongoing discussion about potential changes of the BDC. We conducted 26-year simulations from 1986-2011 with the CTM from different development branches. The spatial resolution is 2.5° x 3.75° (lat/lon), with 29 levels of potential temperature (335-2726 K). Horizontal transport has been calculated from EI wind fields and the vertical transport from EI diabatic heating rates. This study is a necessary step to further evaluate capabilities of our CTM in order to adequately model important transport pathways into and within the stratosphere, which are still debated.

UP 4.4 Tue 16:00 Foyer H41

Development of a 3-channel CE-DOAS system — •Miriam Reh, Martin Horbanski, Stefan Schmitt, Denis Pöhler, and Ulrich Platt — Institut für Umweltphysik, Heidelberg

Halogens, despite their low concentration, influence the atmosphere in a number of ways, e.g. broadening of the ozone hole. Due to their high reactivity, measurements become difficult. A sensitive, contact-free method to measure small concentrations is Differential Optical Absorption Spectroscopy (DOAS), separating narrow band absorption structures of the trace gas species from the broad band absorption of aerosols.

Our aim is to develop a Cavity Enhanced DOAS (CE-DOAS) system, using an open resonator of a length of 2m and a new calibration technique, called Integrated Calibration by means of Optical Modulation (ICOM). Here ICOM is an optically direct method to retrieve the path length $L(\lambda)$ of the light passing through the resonator. By the usage of phase modulation measurements the hurdle of low time resolution spectrometers (typically ms) is overcome.

To measure the concentration of several trace gas species, 3 systems, each with a different high power LED and thus suitable for different trace gases (BrO, OClO, IO, OBrO, NO_2, I_2, OIO), are combined. This allows for simultaneous concentration determination, which is needed to follow the interaction of different halogen species.

Finally the instrument could be used in atmospheric simulation chambers to study chemical transformation in volcanic plumes and for experimentation on halogen gas flux across the sea ice boundary.

UP 4.5 Tue 16:00 Foyer H41

On the Impact of Vibrational Raman Scattering of N_2/O_2 on MAX-DOAS Measurements of Atmospheric Trace Gases — •Johannes Lampel[1], Johannes Zielcke[2], Udo Friess[2], Ulrich Platt[2], and Thomas Wagner[1] — [1]Max Planck-Institute for Chemistry, Mainz, Germany — [2]Institute of Environmental Physics, Heidelberg, Germany

While the first laboratory observation of the Raman effect took place almost 100 years ago, its implications in remote sensing applications, such as the Differential Optical Absorption Spectroscopy (DOAS) of scattered sunlight, still remain under investigation. The main contribution of inelastic scattering is due to rotational Raman scattering, it usually is observed as an additional intensity, leading to filling-in of solar Fraunhofer lines and absorption bands of atmospheric constituents. Measured optical densities are typically corrected for this effect, which is also known as Ring Effect. In contrast to that, Vibrational Raman scattering (VRS) of air was up to now thought to be negligible. We present (1) calculations of vibrational Raman cross-sections of O_2 and N_2 for passive DOAS measurements and show that consequences of

VRS are red-shifted Fraunhofer Ghost Lines (FGL) in scattered light spectra and an additional filling-in of Fraunhofer lines. (2) Based on DOAS measurements during field campaigns, we present first unequivocal observations of FGL at optical densities of up to several 10^{-4}. From our measurements and calculations, we conclude that inclusion of this phenomenon in the spectral evaluation of weak absorbers will lead to considerably more sensitive and precise DOAS measurements.

UP 4.6 Tue 16:00 Foyer H41

The role of soil air composition for noble gas paleotemperature reconstruction — •Florian Jenner[1], Simon Mayer[1], Therese Weissbach[1], Werner Aeschbach[1], Bernhard Peregovich[2], and Carlos Machado[2] — [1]Institut für Umweltphysik, Heidelberg, Germany — [2]UFOPA, Santarém, Brazil

Dissolved noble gases (NGs) in groundwater provide a well-established tool for paleotemperature reconstruction. However, reliable noble gas temperature (NGT) determination needs a detailed understanding of the dynamics of reactive and inert gases in the soil air with which the infiltrating water equilibrates. Due to microbial gas consumption and production, the NG partial pressures in soil air can deviate from atmospheric air, an effect that could offset NGT estimates if not taken into account. Because biological activity is expected to be particularly strong in humid tropical soils, we studied NGs in soil air as well as young groundwater at different sites near Santarém (Pará, Brazil) and for comparison near Heidelberg (Germany). Soil air data confirm a correlation between the sum value of O_2+CO_2 and NG partial pressures. We find significant NG enhancements in soil air by up to 7%. The strongest increase is observed in tropical Santarém, whereas NG excesses vary seasonally in temperate Heidelberg. An observed mass dependent fractionation of NG isotopes in Heidelberg can be explained by the seasonality of O_2+CO_2. However, there is no such effect in Santarém, indicating a year-long NG enhancement in soil air and supporting the expectation that this effect is particularly important in the tropics.

UP 4.7 Tue 16:00 Foyer H41

Retrieval of O2 A-band volume emission rates in the mesosphere and lower thermosphere from SCIAMACHY MLT limb scans — •Amirmahdi Zarboo[1], Stefan Bender[1], Miriam Sinnhuber[1], and John Burrows[2] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]University of Bremen, Bremen, Germany

We use the visible and near infrared spectra in the range 595-811 nm from the SCanning Imaging Absorption spectroMeter for Atmospheric Chartography (SCIAMACHY) on-board the European Space Agency's ENVISAT satellite to retrieve O2 volume emission rates (VERs) from atmospheric emissions in the A-band (759-767 nm) in the mesosphere-lower thermosphere (MLT, 50-150 km) region.

Using single profile retrieval, we retrieve profiles on the measurement grid in the altitude range from 53 to 148 km. We present details of the retrieval algorithm and the latitudinal / altitude variation of the global O2 VER as first results. The whole SCIAMACHY MLT dataset from 08/2007 to 04/2012 will be retrieved. Further it is planned to use the O2 VER also from the nominal limb mode of SCIAMACHY to calculate the temperatures in the MLT region, acquire its time series, and investigate MLT region responses to external forcings.

UP 4.8 Tue 16:00 Foyer H41

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

The influence of solar activity on atomic oxygen (O) formation plays a critical role in the MLT (Mesosphere/Lower Thermosphere) region. We retrieved O concentration ([O]) profiles and studied atmospheric chemistry in the MLT region on a near-global basis with help of SCIAMACHY (SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY) observations of the nightglow green line emission. We estimated the sensitivity of equatorial [O] to the 11-year and 27-day solar cycle forcing represented by such proxy indicators of solar activity as MgII index and Lyman-α with help of the wavelet, cross-correlation and superposed epoch analysis methods. We applied ordinary least squares bisector fitting on MgII index and F10.7 radio flux, which is measured in solar flux units (sfu), to convert the [O] sensitivity values in sfu and finally in percent changes. The same procedure was performed in the case of Lyman-α. Our results of the sensitivity analysis correspond well to the 11-year solar cycle response of O volume mixing ratios found in simulations performed with the WACCM3 (Whole Atmosphere Community Climate Model, v. 3) and the HAMMONIA (3D Hamburg Model of the Neutral and Ionized Atmosphere) model. We identified an 11-year solar cycle variation, quasi-biennial and annual/semi-annual oscillations as well as signatures of the 27-day cycle of solar activity as presented in the MLT O layer.

UP 4.9 Tue 16:00 Foyer H41

Setup and Characterization of an Optical Feedback Cavity System for Nanoparticle Detection — •Jian Shi[1], Mario Nachbar[2], Denis Duft[1], and Thomas Leisner[1,2] — [1]Institut für Meteorologie und Klimaforschung,KIT, Germany — [2]Institute of Environmental Physics, University of Heidelberg, Germany

In the recent past, nanoparticles have gained an enormous interest in environmental science. They are abundant in the atmosphere and can get attracted to the lung and cause health issues as well as act as condensation nuclei and therefore effect the formation of clouds. These effects depend on particle composition as well as surface structure. In many applications, large particle size distributions are investigated and since surface structure and composition varies with particle size, size resolved measurements like in a single particle mass spectrometer are of desire. Currently, these instruments are only able to detect particles down to about 200nm. However, a large amount of particles in the atmosphere are smaller. In this contribution, we present a novel experimental setup based on an optical feedback enhanced cavity system which will allow us to detect scattered light of particles down to about 60nm. This tool will allow us to measure the size of the investigated particle, the position as well as the speed. Introducing such an optical setup in a single particle mass spectrometer or combining it with XPS measurements will allow us to perform size resolved measurements of particle composition and surface structure down to particle sizes of approximately 60nm which represents an enormous improvement in investigating the influence of atmospheric nanoparticles.

UP 4.10 Tue 16:00 Foyer H41

Heterogeneous nucleation and growth of water vapor on nanoparticles at mesospheric conditions — •Mario Nachbar[1], Denis Duft[2], and Thomas Leisner[1,2] — [1]University of Heidelberg, Institute of Environmental Physics, Germany — [2]Karlsruhe Institute of Technology - IMK, Germany

Sub 2 nm meteoric smoke particles (MSP) produced from the ablation and recondensation of meteoric material are believed to be the major kind of nuclei causing the formation of water ice particles in the mesopause of Earth at heights of 80-90 km. These so called NoctiLucent Clouds (NLC) are frequently detected during polar summer, whereas the microphysical nucleation process and subsequent growth on such small particles are understood only poorly. We produce charged nanometer sized (2-3 nm) MSP analogues in a microwave resonator and transfer them to a novel linear ion trap which allows us to trap the particles under typical mesospheric temperatures and H2O concentrations. The adsorption of H2O molecules on the particles surface followed by nucleation and growth 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 contribution we present such measurements for single positively as well as negatively charged particles which allow us to determine the desorption energy of water vapor on the investigated nanoparticles as well as the critical saturation needed to activate nucleation. We will evaluate the influence of the particle charge on the nucleation process and show subsequent growth curves.

UP 4.11 Tue 16:00 Foyer H41

Spurengasmessungen an der südenglischen Küste mithilfe multi-axialer differentieller optischer Absorptionsspektroskopie (MAX-DOAS) — •Nicolai Poggenhans[1], Jan-Marcus Nasse[1], Johannes Lampel[2], Joelle Buxmann[3], Mingxi Yang[4], Udo Friess[1] und Ulrich Platt[1] — [1]IUP Heidelberg — [2]MPIC Mainz — [3]MetOffice, Exeter, GB — [4]Plymouth Marine Laboratory, Plymouth, GB

Insbesondere in Küstenregionen unterliegt die Atmosphäre vielfältigen Einflüssen: Reaktive Halogenverbindungen vom offenen Ozean oder aus küstennahen Algen haben potentiell ebenso einen Einfluss auf die Chemie der Troposphäre wie anthropogene und biogene Emissionen vom Ozean sowie von Land. Um diese Einflüsse genauer spezifizieren zu können, finden seit Frühling 2015 an der englischen Südküste Messungen der Multi-AXis DOAS (MAX-DOAS) Methode statt, die die schräge Säulendichten und Vertikalverteilungen (in Bodennähe) verschiedener

Spurengase ermitteln kann, darunter NO2, IO, BrO, HCHO und SO2. Gleichzeitig werden in-situ CO2, SO2, Methan und weitere Spurengase gemessen, sowie meteorologische Daten erhoben. Die vertikalen Konzentrationsprofile von Aerosolen und Spurengasen werden aus einer Kombination verschiedener Messwinkel und Strahlungstransportmodellen berechnet. Dazu wird ein Inversionsalgorithmus (HEIPRO) genutzt. Wir stellen Messungen der Vertikalprofile verschiedener Spurengase und deren Variation vor und beurteilen anhand von Wetter- sowie Schifffahrtsdaten den anthropogenen Beitrag zur Spurengaskonzentration in der Atmosphäre.

UP 4.12 Tue 16:00 Foyer H41

Investigating the sources of VOC using the ratio of glyoxal to formaldehyde from satellite and ground based measurements — •Leonardo Alvarado, Andreas Richter, Folkard Wittrock, Mihalis Vrekoussis, and John Burrows — Institute of Environmental Physics, University of Bremen, Bremen, Germany

Glyoxal (CHOCHO) and formaldehyde (HCHO) can be used as tracers of volatile organic compounds (VOC) in the atmosphere, because they are intermediate products in the oxidation of most VOC. CHOCHO and HCHO are mainly emitted from natural and anthropogenic sources as well as during fire events. Despite that the sources and chemistry are similar in many respects, the variation in production efficiency for different sources can be used to better constrain source attribution of VOC.

In this study, CHOCHO and HCHO vertical columns retrieved from satellite measurements, are used for the identification of VOC emission sources by computing the ratio of glyoxal to formaldehyde and correlating it with indicators of biogenic emissions (enhanced vegetation index, EVI), fires (fire radiative power, FRP), and anthropogenic activities (nitrogen dioxide: NO2) in order to assess ratio as indicator of VOC specification sources. Additionally, this result is compared with ratios obtained from ground-based measurement over Athens and Nairobi.

UP 4.13 Tue 16:00 Foyer H41

Ice nucleating properties of feldspar in immersion, deposition and contact freezing modes — •Michael Koch, Nadine Hoffmann, Andreas Peckhaus, Thibault Hiron, Alexei Kiselev, and Thomas Leisner — , Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe

Recently we have conducted an extensive experimental investigation of the ice nucleating efficiency of K-feldspar in three heterogeneous freezing modes: immersion freezing, using the freezing droplet assay, deposition nucleation of ice on the feldspar particles in the humidified flow cell, and the contact freezing by exposing a suspended supercooled water droplet to the flow of feldspar particles. We compare the ice nucleating efficiency of feldspar in these three modes by applying the concept of ice active cites being randomly distributed over the surface of ice nucleating particles. We show that with this approach, the observed quantities (fraction of frozen droplets as a function of time, onset water vapor supersaturation, contact freezing probability) can be consistently described with the limited set of parameters defined within the classical nucleation theory formulation. Finally, we discuss the ageing effect on the ice nucleating efficiency of various feldspar varieties.

UP 4.14 Tue 16:00 Foyer H41

Variations of the BrO/SO_2 ratios from Tungurahua volcano, Ecuador — •Simon Warnach[1], Peter Lübcke[1], Florian Dinger[1,2], Nicole Bobrowski[1,3], Silvana Hidalgo[4], Santiago Arellano[5], Jean Battaglia[6], Christoph Hörmann[2], Mario Ruiz[4], Leif Vogel[7], Thomas Wagner[2], and Ulrich Platt[1] — [1]IUP, Heidelberg — [2]MPIC, Mainz — [3]Institut f. Geowiss., Mainz — [4]IGNEP, Quito, Ecuador — [5]Chalmers Univ., Gothenburg, Sweden — [6]Lab. Magmas et Volcans, Blaise Pascal, France — [7]Basque Centre for Climate Change, Bilbao, Spain

The composition of volcanic gas emissions, in particular the molar ratio of BrO/SO_2, has shown the potential for interpreting volcanic activity. This has been shown for long term spectral data collected through the Network for Observation of Volcanic and Atmospheric Change (NOVAC) at Nevado del Ruiz.

We retrieve the BrO and SO_2 column densities at Tungurahua volcano, Ecuador, and present a time series of the BrO/SO_2 ratio for several eruptive phases between 2007 and 2014. The variation of the BrO/SO_2 ratio during these eruptive phases is compared to seismic data and volcanological phenomenological observations as well as satellite and ground based SO_2 measurements. During several eruptive phases we observe an increase in the BrO/SO_2 ratio on the transition from high explosive activity to low explosive activity. On such a transition during December 2010 for example we observe an increase of the BrO/SO_2 ratio from 5.1×10^{-5} and to 8.5×10^{-5}.

UP 4.15 Tue 16:00 Foyer H41

A comparison of 10 year mesospheric and lower thermospheric wind determined by meteor and MF radar at 69°N. — •Sven Wilhelm, Gunter Stober, and Jorge Luis Chau — Leibniz Institute of Atmospheric Physics at the Rostock University, Kühlungsborn, Germany

Since the year 2004 we measure continuously information about the mesospheric and lower thermospheric dynamics by operating the MF SAURA and the Andenes meteor radar (SMR) at northern Norway(69°N, 16°E). Here we present a comparison of the derived winds between both radar systems in order to quantify potential biases between the observations. In order to understand the gravity wave forcing at mesospheric altitudes it is essential to measure the wind velocity with the highest possible accuracy. As there is an overlap between 78-100 km of the observation altitudes it is possible to investigate potential altitude dependent differences in order to derive to access an altitude ceiling for the MF radars due to the increasing background electron density. Our results indicate that here is a strong dependence of the wind agreement with altitude. The highest correlation is reached for altitudes between 80 * 88 km taking values of 0.60 * 0.70. Above 88 km the correlation decreases rapidly and shows almost no correlation at altitudes above 98 km.

UP 5: AKE und UP: Energiewende und Klimawandel

Time: Wednesday 9:20–11:30 Location: H41

Begrüßung durch Prof. Bruhns (AKE) und Prof. v. Savigny (UP)

Invited Talk UP 5.1 Wed 9:30 H41

Globale Klimavariabilität im Industriezeitalter - Phänomene und Ursachen — •Christian-Dietrich Schönwiese — Goethe-Universität, Inst.f. Atmosphäre u. Umwelt, Postfach 111932, 60054 Frankfurt a.M.

Die Schätzwerte der global gemittelten bodennahen Lufttemperatur (Landgebiete und Ozeane) ab 1850 bzw. 1880 sind im Gegensatz zu anderen Klimagrößen besonders zuverlässig und genau. Sie zeigen einen langfristigen Erwärmungstrend, der überwiegend durch die anthropogene Emission klimawirksamer Spurengase verursacht ist, aber auch überlagerte anthropogene (Aerosole)sowie natürliche (Vulkanismus, Sonnenaktivität, El Nino usw.) Fluktuationen. Sie können den Erwärmungstrend vorübergehend abschwächen oder gar umkehren. Eine solche Abschwächung (Hiatus) ist 1998-2013/14 eingetreten, aber 2015 war ein neues markantes Wärmerekordjahr. Diese gesamte Klimavariabilität ist durch aufwändige physikalische Klimamodelle bzw. statistische Studien (z.B. neuronale Netze) gut verstanden.

Invited Talk UP 5.2 Wed 10:00 H41

The 2°C climate policy goal: Chances & Challenges — •Hermann Held — University of Hamburg, Center for Earth System Research and Sustainability, Grindelberg 5, D-20144 Hamburg

The Conference of Parties held end of 2015 in Paris re-confirmed the so called 'two-degree target' (2°-target) as the global goal of climate policy. It encodes the consensus to limit an anthropogenically induced increase of global mean temperature to 2°C. The latest IPCC (Intergovernmental Panel on Climate Change) report (2014) summarizes cost estimates that can be interpreted as rather low, suggesting some political feasibility of the 2°-target. However in terms of an agreement on concrete cuts of greenhouse gas emissions, most likely there

will be a gap, equivalent to about 1°C global warming. Furthermore, our work has shown that the 2° target requires a somewhat refined definition and interpretation once one acknowledged a probabilistic, long-tailed climate response to greenhouse gas forcing, in combination with anticipated future learning 'dynamic decision-making'). Here we present a generalization of the 2°-target that respects dynamic consistency under anticipated future learning. Consequences for climate policy are highlighted, including the possibility of a delayed 2° policy. We find that previous climate economic analyses of the 2°-target in terms of low cost for transforming the energy system are still valid, when being re-interpreted. Moreover, mitigation costs could be reduced by up to 1/3 if the climate response to greenhouse gas forcing were known with certainty, pointing to the expected economic value of geo-scientific information.

Invited Talk UP 5.3 Wed 10:30 H41

How regional climate interacts with wind power generation — •Robert Vautard — LSCE Orme des Merisiers 91191 Gif sur Yvette CEDEX

Climate change mitigation with ambitious targets such as those of the Paris agreement require that by 2050 electricity generation be almost completely decarbonized [IPCC, 2014]. This will require a large share of renewable energy production such as wind power. Wind power generation depends itself on climate variability and potentially modifies regional climate. I will review the impacts of climate change on wind power resource and generation in Europe and potential effects of a large share of wind power in Europe. We show that wind power resource is likely to decrease in many European areas, especially in Mediterranean areas. Interactions between wind turbines and the atmosphere also lead to potential regional impacts on climate and wind resource itself. I will give an overview of such effects for Europe found in previous studies and propose research directions to better quantify these effects.

Invited Talk UP 5.4 Wed 11:00 H41

Offshore-Windenergienutzung - Chancen, Herausforderungen und Auswirkungen aus meteorologischer Sicht — •Stefan Emeis — Karlruher Institut für Technologie, Campus Alpin, Garmisch-Partenkirchen

Einen größeren Beitrag zur Energiewende sollen große offshore-Windparks darstellen. Vorteile liegen in den über See zur Verfügung stehenden großen Flächen, der gegenüber dem Festland im Mittel höheren Windgeschwindigkeit, der geringeren Turbulenzintensität der Anströmung und der geringeren vertikalen Windscherung in Höhe der Rotorblätter. Die ersten beiden Fakten garantieren höhere Erträge, die anderen Punkte bedeuten eine geringere mechanische Belastung der Windturbinen. Diese Technik bringt neue Herausforderungen aus meteorologischer Sicht. Die geringere Oberflächenreibung über See bringt höhere Extremwindgeschwindigkeiten mit sich. Die deutlich geringere Turbulenzintensität verlängert Nachläufe hinter den einzelnen Windturbinen und hinter ganzen Windparks erheblich. Damit müssen über See höhere Abstände zwischen den einzelnen Turbinen im Park und zwischen den Parks als Ganzen eingeplant werden, um bei gleicher Windgeschwindigkeit denselben Ertrag wie über Land zu erzielen. Eine größere Zahl von großen Windparks wird das regionale Klima in dem Seegebiet und in den angrenzenden Küstenländern beeinflussen. Vermehrte Wolkenbildung und vielleicht sogar eine geänderte Niederschlagsverteilung sind denkbar. Das vom BMWi kürzlich genehmigte Verbundforschungsvorhaben WIPAFF wird diese Fragestellungen in den nächsten drei Jahren untersuchen.

UP 6: Additional Topics

Time: Wednesday 11:45–12:45 Location: H41

Invited Talk UP 6.1 Wed 11:45 H41

Estimating wind energy limits and atmospheric impacts at large scales from climate model simulations and first principles — Lee Miller and •Axel Kleidon — MPI Biogeochemie, Jena. Germany

Wind turbines generate electricity by removing kinetic energy from the atmosphere. When wind power is used at large scales, this removal results in reduced wind speeds that cannot be accounted for in large-scale wind power estimates derived from climatological wind speeds. Here we test how well wind power limits and this slowdown effect can be accounted for from first principles that are based on the momentum balance and the vertical downward flux of kinetic energy to the surface (VKE method). To do so, we apply VKE to the simulated control climate of a global climate model and compare the VKE estimates to the maximum wind power generation simulated by a set of sensitivity simulations ("GCM estimate"). On land, we find strong agreement between VKE and the GCM estimate, both with respect to generation rates (0.37 and 0.32 We m-2) as well as the reductions in wind speed by 42% and 44%. Over the ocean we find the GCM estimate to be about twice the VKE estimate (0.59 and 0.29 We m-2), yet wind speed reductions by 50% and 42% are comparable. We attribute this underestimation of generation rates to the common stable to neutral atmospheric conditions over the ocean. This offset between VKE and the GCM estimates over the ocean can be corrected for, so that VKE is a powerful approach to estimate more realistic wind power limits at large scales.

UP 6.2 Wed 12:15 H41

a drying and thermoelastic model for microwave ablation of concrete — •benjamin lepers[1] and guido link[2] — [1]KIT, hermann von helmholtz platz 1, 76344 eggenstein leopoldshafen, Germany — [2]KIT, hermann von helmholtz platz 1, 76344 eggenstein leopoldshafen, Germany

The use of high power microwaves to perform explosive spalling of concrete surfaces is a promising technique with applications in the area of concrete facilities decommissioning. The mechanism that creates explosive spalling is due to a combination of the thermal stress from high temperature gradients and the pore pressure generated from the water vaporization and water transport through a porous medium. In this paper a one dimensional model solving the heat and diffusion equations for liquid and vapor phase with the COMSOL Multiphysics finite element software is presented. The modelling of the drying process is based on the spatial reaction engineering approach (SREA). This paper discusses the influence of the relative activation energy parameter and effective diffusion coefficients on the temperature, water content and pore pressure in the case of fast microwave heating of concrete. This model is then used for a 3d geometry with a sealed insulated block of concrete and an conical waveguide antenna to compute the thermal stress, pore pressure and total stress

UP 6.3 Wed 12:30 H41

Applications of ^{39}Ar-ATTA in the environment: pilot studies for ocean- and ice-research — Stefan Beyersdorfer[1], •Florian Ritterbusch[1], Arne Kersting[1], Emeline Mathouchanh[1], Sven Ebser[2], Zhongyi Feng[2], Helene Hoffmann[1], Toste Tanhua[3], Werner Aeschbach[1], and Markus K. Oberthaler[2] — [1]Institute of Environmental Physics, Heidelberg University, Germany — [2]Kirchhoff-Institute for Physics, Heidelberg University, Germany — [3]GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Germany

Atom Trap Trace Analysis (ATTA) is a novel ultra-sensitive detection method for rare noble gas radioisotopes. In Heidelberg, an ATTA setup has been realized for ^{39}Ar (half-life 269 a) which is the only reliable dating isotope for water and ice in the range of 50-1000 a. After the successful demonstration of ^{39}Ar dating for large groundwater samples (1-2 m^3 of water) current developments aim at shorter measurement times and smaller sample sizes of 10-25 L of water or 4-10 kg of ice. An argon extraction system for such samples based on vacuum degassing and a Ti-Getter has been developed, achieving argon purities $> 98\%$ and recoveries $> 95\%$. The extraction system has been used for the preparation of samples from a pilot study for ^{39}Ar dating of ocean water masses in the oxygen minimum zone of the Eastern Tropical North Atlantic. Moreover, samples have been processed from a pilot study at the Gorner Glacier (Swiss Alps), which uses ^{39}Ar to provide an absolute age for different positions along the flowlines. The developed sample preparation methods are an important ingredient for the wide range of future applications that the advent of ^{39}Ar-ATTA opens up.

UP 7: Mitgliederversammlung

Time: Wednesday 12:45–14:15 Location: H41

Mitgliederversammlung des Fachverbandes mit Mittagsimbiss, Gäste willkommen

UP 8: Hydrosphere, Soil and Agricultural Physics

Time: Wednesday 14:15–15:15 Location: H41

Invited Talk UP 8.1 Wed 14:15 H41

Niederschlagsmessung mit Richtfunkstrecken kommerzieller Mobilfunknetzwerke — •Harald Kunstmann[1,2], Christian Chwala[1] und Felix Keis[1] — [1]Karlsruher Institut für Technologie, Campus Alpin, Garmisch-Partenkirchen — [2]Universität Augsburg, Augsburg

Die exakte Erfassung der raumzeitlichen Niederschlagsvariabilität bleibt eine Herausforderung: die Interpolation zwischen Niederschlagsstationen kann gerade im komplexen Gelände oder bei geringen Stationsdichten zu großen Unsicherheiten in der Niederschlagsbestimmung führen. Ebenso bleibt die Ableitung von Niederschlagsmengen aus Radarreflektivitäten für hydrologische Anwendungen häufig problematisch. Neben diesen beiden klassischen Punkt- und flächenhaften Niederschlagsmessungen (Station und Radar) gibt es zusätzlich die Möglichkeit linienintegrierte Werte für Niederschlagsmengen zu erhalten. Dies wird ermöglicht über die niederschlagsinduzierte Abschwächung (Dämpfung) der Mikrowellensignale im Bereich zwischen 10 und 40 GHz, ein Frequenzbereich wie er bei den Richtfunkstrecken der Mobilfunkbetreiber eingesetzt wird. Wir präsentieren Analysen für den alpinen Raum der Region Garmisch-Partenkirchen und unser neu entwickeltes Erfassungssystem, das den direkten Zugriff auf beliebige Mengen von Strecken des jeweiligen Netzes (hier Ericsson) ermöglicht. Das System erlaubt erstmals Daten in Echtzeit für die wissenschaftliche Auswertung und könnte in Zukunft für flächendeckende Anwendungen auch im Nowcasting Bereich verwendet werden.

UP 8.2 Wed 14:45 H41

Evaluation of short-term noble gas fluctuations in groundwater and soil air in a two year study — •Simon Mayer, Florian Jenner, Therese Weissbach, and Werner Aeschbach — Institut für Umweltphysik, Heidelberg, Germany

The application of noble gases (NGs) in environmental tracer studies such as noble gas temperature (NGT) determination based on the temperature dependent dissolution of NGs in groundwater requires an exact knowledge of subsurface soil air composition. While deviations of soil air NG partial pressures from atmospheric values have already been found, an impact on NG contents of groundwater has not been investigated so far. We provide the first long-term study of NGs and physical parameters in both the saturated and unsaturated soil zone, sampled continuously for more than 2 years near Mannheim (Germany). Results show that NG partial pressures in soil air correlate with the sum value of O_2+CO_2 and thus differ seasonally from atmospheric values with an enhancement during summer time. Such soil air composition records allow to improve the reliability of NGTs in groundwater. There is evidence for a smoothing of short-term NG fluctuations in shallow groundwater within a few meters of increasing soil depth. Data indicates a further continuous equilibration of groundwater with entrapped air bubbles within the topmost saturated zone, even some years after recharge. Local subsurface temperature fluctuations may thus lead to subsequent variations of NG contents in groundwater, independent of the former recharge temperature, even though this effect is only relevant for shallow groundwater.

UP 8.3 Wed 15:00 H41

Drying in microfluidic cells as a model granular material — •Paolo Fantinel[1], Oshri Borgman[2], Wieland Lühder[1], Ran Holtzman[2], and Lucas Goehring[1] — [1]Max Planck Institute for Dynamics and Self-organization, 37077 Göttingen, Germany — [2]The Hebrew University of Jerusalem

We study the drying of porous granular materials on a microscopic scale in order to better understand drying mechanisms on the macroscopic scale. We aim to validate a 2D pore-scale model by experimental observations. The long-term goal is that of extending such class of models to real phenomena like water exchange between soil and atmosphere, invasion percolation and CO2 sequestration. To model a granular material we use microfluidic cells made of an array of round pillars, which represent the soil grains. The cells are open at one end to allow evaporation. We introduce different degrees of heterogeneity by changing the size and positions of the particles, as would be the case in a real, randomly packed, granular material. This heterogeneity can be random or vary over a given correlation length. We flood the cells with a wetting volatile fluid and observe them as they dry. After an initial phase where evaporation happens mainly at the surface, we see the formation of several isolated clusters of fluid which evolve further in time. In order to characterize the resulting patterns, we use three Minkowski measures. These give us information on roughness of the leading front, connectivity of the dry area and saturation of the sample. Microfluidic experiments are coupled with simulations in order to validate our pore-scale model.

UP 9: Poster Session

Time: Wednesday 15:15–17:15 Location: Foyer H41

Poster session continued, all posters

UP 10: Abendvortrag von Prof. Jochem Marotzke

Time: Wednesday 20:00–21:00 Location: H1

Evening Talk UP 10.1 Wed 20:00 H1

Vorhersagen sind schwierig ... Möglichkeiten und Grenzen von Klimamodellen — •Jochem Marotzke — Max-Planck-Institut für Meteorologie, Bundesstr. 53, Hamburg

Besonders schwierig sind Vorhersagen über eine Zukunft jenseits des menschlichen Erfahrungshorizonts, und um solche handelt es sich, wenn wir den Klimawandel bis zum Ende des 21. Jahrhunderts betrachten. Wir müssen uns dabei auf höchst abstrakte Werkzeuge verlassen, nämlich auf Klimamodelle. Dieser Vortrag wird die Möglichkeiten und Grenzen von Klimamodellen ausloten: Worauf basieren sie? Können wir ihren Ergebnissen vertrauen, und wenn ja, warum? Gibt es fundamentale oder praktische Grenzen ihrer Vertrauenswürdigkeit? Die Antworten liegen in grundlegenden Aspekten der Physik.

UP 11: Atmosphere - Trace Gases

Time: Thursday 10:00–11:15 Location: H41

Invited Talk UP 11.1 Thu 10:00 H41

Towards disentangling natural and anthropogenic CO2 and CH4 fluxes using space based measurements of XCO2 and XCH4 — •Heinrich Bovensmann, Michael Buchwitz, Konstantin Gerilowski, Sven Krautwurst, Thomas Krings, Maximilian Rauter, Oliver Schneising, Jens Heymann, and John P. Burrows — Institut für Umweltphysik, Universität Bremen

The concentrations of CO2 and CH4 in the atmosphere are affected directly by anthropogenic activity (fossil fuel combustion, biomass burning, agriculture and land usage change) and natural phenomena. Adequate knowledge of the sources and sinks of both gases, as well as the related feedbacks is a pre-requisite for the reliable prediction and management of the future climate of our planet. In spite of the recognised importance of this issue, our current understanding about sources and sinks of the greenhouse gases CO2 and CH4 is still inadequate. During the last years, data from SCIAMACHY on ENVISAT as well as from GOSAT have demonstrated that atmospheric columns of CO2 and CH4 provide unique information about changes in greenhouse gas fluxes and its linkage with climate feedbacks, despite some limitations in data coverage and quality. In parallel airborne remote sensing of XCO2 and XCH4 make substantial progress in demonstrating that emissions from strong local point sources can be derived from such measurements. The talk will present recent progress made in greenhouse gas research using airborne and satellite data of CO2 and CH4 and will give an outlook on future greenhouse gas satellite missions like the CarbonSat concept.

Invited Talk UP 11.2 Thu 10:30 H41

AIRCORE as a new tool to study stratospheric age of air — •Andreas Engel and Harald Bönisch — Goethe Universität Frankfurt, Institut für Atmosphäre und Umwelt

Mean age of air is a fundamental parameter describing the tracer-transport in the stratosphere. It can be determined from long lived tracers without sinks or sources in the region of interest, which show steady and monotonous trends in the atmosphere.

Observations of the most common mean age tracers, SF6 and CO2, so far required heavy and difficult to launch instrumentation. So far large and very expensive balloons were needed to carry instrumentation up to 30 km altitude. A new method for collecting stratospheric air has been described by Karion et al. (2010), and has been named AIRCORE. This method relies on collecting stratospheric air in a long and thin-walled tube during the descent of a balloon. Due to the weight of the tube, which can be below 2.5 kg, a launch on small and inexpensive radio sonde balloons is possible. Due to the length of the tube the information on the chemical composition of the air is conserved for some time in a similar way as in an ice core. However, the information is lost due to diffusion after some time.

We present first stratospheric observations of CO2, CH4 and CO based on this method during balloon flights in Timmins, Canada in August 2014 and 2015. We discuss the applicability of the method for mean age determination and the altitude range for which results can be obtained. Finally we present the new mean age results in context with previous observations of mean age nad long term trends.

Kaffeepause (15 min)

UP 12: Methods - Remote Sensing

Time: Thursday 11:15–13:45 Location: H41

UP 12.1 Thu 11:15 H41

Accurate prototype remote sensing of correlated CO_2 and SO_2 emissions at Mt.Etna — •Anna Solvejg Dinger[1], André Butz[2], Nicole Bobrowski[1,3], and HeiKa Team[1,2] — [1]IUP, University of Heidelberg, Germany — [2]IMK-ASF, Karlsruhe Institute of Technology, Germany — [3]University of Mainz, Germany

Volcanic carbon dioxide (CO_2) and sulfur dioxide (SO_2) emissions have a direct as well as an indirect impact on climate and air quality. Moreover the ratio of these two gases is a tracer for dynamic processes inside volcanoes and hence volcanic activity. Remote sensing of volcanic emissions allows for monitoring a volcano's activity from a safe distance to the volcano. Further it enables sampling of cross sections of the entire plume, which suffer less from representativeness errors than common in-situ techniques. Remote sensing of SO_2 is well developed, whereas the measurement of volcanic CO_2 requires high accuracy in order to measure little concentration enhancements above the atmospheric background. We employed combined direct sunlight spectroscopy for SO_2 (UV-DOAS) and CO_2 (FTIR) during a three-week campaign at Mt.Etna, Sicily. The whole setup was installed on a mobile platform, which allowed for sampling plume cross sections in a stop-and-go pattern. We measured significant CO_2 column density enhancements, even though the enhancement was only slightly above the detection limit. Our measured volcanic CO_2 and SO_2 column densities show a strong correlation and their emission ratios are in the range of 5-15.

UP 12.2 Thu 11:30 H41

Detection of noctilucent clouds in SCIAMACHY/Envisat nadir UV-measurements — •Langowski Martin and Christian von Savigny — Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Deutschland

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 about 83 km they are still illuminated several hours after/before sunset/sunrise. As NLCs were first observed in 1885, it is discussed if they are an indicator for climate change. Some long term studies show a long term trend, while others do not. An issue in this analysis is that long term studies rely on satellites with drifting local time. Currently a new algorithm for the GOME, SCIAMACHY and GOME-2 instruments is being developed to extend the NLC data from nadir measurements. This algorithm is an adaption of the algorithm used in other long term studies to the specifications of the three instruments. The algorithm searches for strong positive deviations in the albedo of different nadir measurements, which are caused by a higher reflection of solar radiation by the NLCs. The instruments are very similar and have a similar local time (9:30, 10:00 and 10:30) at the descending node during their whole measurement period. We aim to retrieve NLC albedo, occurrence rate and ice water content for all three instruments which until now combine 20 years of nadir data. This data set will then by analyzed for long term trends.

UP 12.3 Thu 11:45 H41

Designing a muon detector for volcanoes — •Lukas Fieber[1], Nicole Bobrowski[1,2], Markward Britsch[3,4], Ulrich Platt[1], and Michael Schmelling[4] — [1]IUP, Heidelberg, Germany — [2]University of Mainz, Mainz, Germany — [3]Physikalisches Institut, Heidelberg, Germany — [4]Max Planck Institut für Kernphysik, Heidelberg, Germany

High energy muons can penetrate about one kilometer of rock. Measurements of the absorption of cosmic ray muons can be used to determine the density profile of the material traversed by these particles. Applying this method to a volcanic edifice can open a window to its inner structure and even the magma level. This method improves the resolution by one order of magnitude compared to traditional measurement methods like seismologic and electromagnetic ones.

Such investigations have been carried out by several research groups using scintillator detectors with an exposure time of the order of a month. The results obtained are very promising and could indicate that muon detection techniques will play a key role in volcano structure analysis and understanding volcano eruption dynamics.

Our aim is to build a muon detector, using a detector material such that the exposure time can be reduced by enlarging the detection area without unduly increasing the costs. The detector should be functional

in the given environment of volcanoes, meaning low power consumption, relatively small and easy to transport. To achieve this goal, we look into alternatives to the standard detection devices. Theoretical considerations and practical tests will be presented.

UP 12.4 Thu 12:00 H41

Quantitative Imaging of Volcanic Plumes, Recent Developments and Future Trends — •Ulrich Platt, Peter Lübcke, Jonas Kuhn, and Nicole Bobrowski — Universität Heidelberg, Deutschland

There are a number of indicators for volcanic activity including seismic events, deformation, and gaseous emissions. While the former two indicators have been routinely monitored at many active volcanoes, long term monitoring of gas fluxes and gas emission is only now becoming a standard approach and thus help to better forecast volcanic events. Recently developed remote sensing techniques allow two-dimensional "imaging" of trace gas distributions in volcanic plumes in real time. In contrast to older, one-dimensional remote sensing techniques, which are only capable of measuring total column densities, the new imaging methods give insight into details of transport- and mixing processes as well as chemical transformation within plumes. We give an overview of gas imaging techniques already being applied at volcanoes (SO2 cameras, imaging DOAS, Fabry-Pérot imaging), present techniques where first field experiments were conducted (LED-LIDAR, tomographic mapping), and describe some techniques where only theoretical studies with application to volcanology exist (e.g. Gas Correlation Spectroscopy, bi-static LIDAR). Finally, we discuss current needs and future trends in gas imaging technology.

Mittagspause (90 min)

UP 13: Environmental Technology

Time: Thursday 13:45–14:15 Location: H41

Invited Talk UP 13.1 Thu 13:45 H41

NO_2 Luftverschmutzung und Emissionen von Fahrzeugen unter realen Fahrbedingungen — •Denis Pöhler[1], Florian Kanatschnig[1], Tobias Österle[1], Martin Horbanski[1], Axel Friedrich[2], Johannes Lampel[1,3] und Ulrich Platt[1] — [1]Institut für Umweltphysik, Universität Heidelberg — [2]Internationaler Verkehrsberater — [3]MPIC, Mainz; Deutschland

Stickoxid Emissionen (NO_x = NO + NO_2) von Fahrzeugen sind die Hauptursache für schlechte Luftqualität in Ballungsräumen. So werden in vielen deutschen Städten die Grenzwerte für NO_2 überschritten und das nicht nur an Hauptverkehrsstraßen wie gezeigt wird. Zur Quantifizierung der Verursacher sind jedoch Emissionsmessungen möglichst aller Fahrzeuge unter wahren Fahrverhalten nötig. Nicht nur seit dem VW Skandal ist bekannt, dass diese Emissionen stark von den offiziellen Emissionsdaten abweichen und große Unterschiede zwischen den Fahrzeugen existieren. Zur Messung wenden wir ein neues mobiles NO_2 Messsystem basierend auf dem Iterative Cavity DOAS (ICAD) Verfahren an. Damit ist es erstmals ermöglicht einfach die Emissionen einer Vielzahl an Fahrzeugen zu bestimmen, wobei einfach in der Abgasfahne der Fahrzeuge gemessen wird. Die Ergebnisse zeigen das einzelne Fahrzeugmodelle verschiedenster Hersteller besonders hohe Emissionen aufweisen, die damit einen Großteil der Gesamtemissionen verursachen. Korrekturen der offiziellen Emissionsdaten und Modellrechnungen sind daher nötig die Grundlage für die Verbesserung der Luftqualität darstellen.

UP 14: Methods - Data evaluation and Modelling

Time: Thursday 14:15–15:15 Location: H41

UP 14.1 Thu 14:15 H41

Determining volcanic SO_2 plume heights in satellite observations using meteorological wind fields — •Viktoria Keicher[1,2], Christoph Hörmann[1], Holger Sihler[1], Ulrich Platt[2], and Thomas Wagner[1] — [1]Max Planck Institute for Chemistry, Mainz, Germany — [2]Institute of Environmetal Physics, University of Heidelberg, Germany

Satellite observations provide the global monitoring of volcanic plumes via sulphur dioxide (SO_2) that is injected into the Earth's atmosphere. In turn, SO_2 may lead to the formation of sulphate aerosols that can influence climate via direct and indirect radiative effects.

In recent years, satellite observations helped to improve global SO_2 estimates. Passive satellite remote sensing offers the opportunity to observe the location of a plume in two dimensions, but information about the corresponding height is sparse. This information is important for the quantitative interpretation of satellite observations and to assess the radiative effect of volcanic plumes.

Here, we present first results for a newly developed approach using the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT) in combination with data for different volcanic SO_2 plumes as observed by the second generation Global Ozone Monitoring Instrument (GOME-2). The main plume information that can be retrieved are used as input parameters in order to estimate the plume's profile at the time of the measurements. We use the calculated trajectories to further estimate eruption time and height for several case studies.

UP 14.2 Thu 14:30 H41

Spatiotemporal image analysis of water flow in porous media for numerical transport modelling — •Johanna Lippmann-Pipke[1], Sebastian Eichelbaum[1,2], and Johannes Kulenkampff[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Institut für Resourcenökologie, Forschungsstelle Leipzig, Deutschland — [2]Nemtics Visualization, Leipzig

For more than a decade a spatiotemporal visualization tool for transport process observations in dense material by means of PET (positron emission tomography) was developed [1-5]. Such quantitative GeoPET images are exceptionally sensitive to displacements of pico molar tracer quantities detected within 1 mm grids on laboratory/drill core scale.

Now we reached a strategic milestone: A custom made image analysis algorithm is capable of quantitatively extracting velocity and porosity fields from such GeoPET image time series, even if the 4D image information includes discontinuous flow patterns (due to bottle neck effect related detection limits) and localized image artifacts. We present our approach with a concrete example: From an observed flow field in a dense core material the effective porosity and velocity field is extracted and this data is used in a finite element based transport simulation.

[1] Richter, M., et al. (2000) Z.angew.Geol. 46(2): 101-109. [2] Gründig, M., et al. (2007) App.Geochem. 22: 2334-2343. [3] Zakhnini, A., et al. (2013) Comp.Geosci. 57 183-196. [4] Kulenkampff, J., et al. (2008) Phys.Chem.Earth 33: 937-942. [5] Kulenkampff, J., et al. (2015) Clay Min. accepted 2015.

Kaffeepause (30 min)

UP 15: Methods - Measurement Techniques

Time: Thursday 15:15–16:00 Location: H41

UP 15.1 Thu 15:15 H41

The method of soil moisture sensing by cosmic ray neutrons — •Markus Köhli[1], Martin Schrön[2], and Ulrich Schmidt[1] — [1]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Germany — [2]Helmholtz-Zentrum für Umweltforschung - UFZ, Leipzig

Probing soil moisture at intermediate scales in between those of satellite based systems and local measurements has turned out to be feasible by detecting environmental neutrons. The technique of passively sensing neutrons originating from cosmic particle air showers offers the possibility of detecting water by averaging over hectares. The key characteristic of the method is the exceptionally high moderation performance of hydrogen. It slows down fast neutrons whereas other heavier elements independent of the chemical composition rather reflect them. The environmental neutron density therefore strongly depends on the water content present around the sensor. We present Monte Carlo based simulations and measurements to study the footprint of this method for various conditions. Intensity and range dependencies can now be described by analytical functions. Especially the altitude of the sensor is the target of interest.

UP 15.2 Thu 15:30 H41

Correlative Microscopy at ProVIS - Centre for Chemical Microscopy — •Matthias Schmidt, Hryhoriy Stryhanyuk, Hans Richnow, and Niculina Musat — Helmhotlz-Centre for Environmental Research (UFZ) Leipzig, Germany

The UFZ has established the ProVIS - Centre for Chemical Microscopy, recently. ProVIS aims to visualise biochemical processes on cellular level. It comprises of equipment for sample preparation, a number of different microscopes - fluorescence, electron (SEM)- and helium ion microscopes (HIM) and imaging mass-spectrometers. We will present a correlative microscopy study on an environmental sample of microbes and sediments taken from the Davidschacht mine-tailings. The sample was filtrated on a Pd/Au sputter-coated filter, chemically fixed, fluorescence in-situ hybridised (FISH) and critical-point-dried. In order to detect the positions of bacteria on the filter fluorescense microscopy was employed and the regions of interest (ROIs) were laser-marked. In the SEM and HIM providing a lateral as well as depth resolution of significantly better than 4nm the morphology of the bacteria detected by FISH was investigated. The chemical composition of the sediments in the sample was investigated by energy dispersive X-ray spectroscopy. Further chemical information was gained from nanoSIMS experiments. The results obtained by the different methods were correlated and overlayed using the ImageJ-plugin CORRELIA which we have developed at ProVIS.

UP 15.3 Thu 15:45 H41

High-resolution turbulence observations in the stratosphere with LITOS — •Jens Söder, Michael Gerding, Andreas Schneider, and Franz-Josef Lübken — Leibniz-Institut für Atmosphärenphysik an der Universität Rostock, Kühlungsborn

Many studies show that gravity waves dissipate a distinct amount of energy while propagating through the stratosphere, even if this region is in general statically and dynamically stable. For studies of stratospheric turbulence and wave dissipation we have developed the balloon-borne instrument LITOS (Leibniz-Institute Turbulence Observations in the Stratosphere), resolving structures in the atmospheric wind field down to the scales of millimeters. LITOS data cover both the inertial and viscous subrange of the energy spectrum, allowing for the most direct calculation of energy dissipation rates. Recently, a new version of LITOS has been developed that can be launched from every radiosonde station. We have performed several flights from Kühlungsborn/Germany (54°N, 12°E), thereof one during nighttime. Various turbulent layers with a vertical thickness in the order of a few 10 m have been observed. Stratospheric energy dissipation rates greatly vary within only a few tens of meters, roughly between 1e-7 and 10 W/kg, with a mean value of roughly 1e-3 W/kg. Huge differences have been found in the altitudinal structure and strength of stratospheric turbulence during the different flights. The outcome of the flights will be discussed in their geophysical context. Furthermore, first results from the METROSI-LITOS campaign at Andenes/Norway (69°N, 16°E) in January 2016 are presented.

UP 16: Atmosphere - Laboratory Studies

Time: Thursday 16:00–16:30 Location: H41

UP 16.1 Thu 16:00 H41

Heterogeneous ice nucleation and growth on small nanoparticles heated up by light absorption — •Kensei Kitajima[1], Mario Nachbar[2], Denis Duft[3], and Thomas Leisner[2,3] — [1]Kyoto University, Kyoto, Japan — [2]University of Heidelberg, Heidelberg, Germany — [3]KIT, Karlsruhe, Germany

Heterogeneous ice nucleation on sub-2nm meteor smoke particles (MSP) plays an important role on the cloud formation in the mesopause region of Earth at heights of 80-90 km. Noctilucent clouds (NLC) in this region have attracted much attention as a peculiar phenomenon observed only during the polar summer. However, very little is known about the physicochemical formation process of NLC so far. An experimental system is required to clarify the nucleation and growth process on MSPs under realistic mesopause conditions. The TRAPS apparatus at KIT is used to investigate the heterogeneous nucleation process on MSPs by observing the mass growth rate of nanoparticles trapped under controlled H2O temperature and pressure with a time-of-flight mass spectrometer. We have recently developed an additional experimental system allowing us to expose the trapped nanoparticles to laser irradiation to study the heat-up behavior of MSPs by solar light absorption during the polar summer. In this study we compare the amount of adsorbed water molecules on the MSP analogues with and without laser irradiation of different input powers to infer the heat up of the particles and determine their absorption cross section. In addition, we discuss how temperature changes of the nanoparticles affect the ice nucleation and growth process.

UP 16.2 Thu 16:15 H41

Heterogeneous nucleation of ice on mineral surfaces: the effect of crystal microstructure — •Alexei Kiselev and Thomas Leisner — Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Mineral dust have been shown to be the most abundant ice-nucleating particle (INP) type in the Earth's atmosphere. However, the ice nucleating efficacy of mineral dust ranges over orders of magnitude and the question, what property (or combination of properties) is responsible for any particular mineral dust aerosol being bad or good INP, is still under debate. In the recent experiments on the deposition growth of ice on feldspar conducted in an Environmental Scanning Electron Microscope (ESEM), we have noticed that ice crystals preferentially nucleate at sites where ideal crystalline structure of feldspar is distorted due to the twinning or exsolution of different feldspar types: K-rich microcline and Na/Ca-rich albite. At the same time the crystal lattice distortion does not destroy the orientation alignment of ice crystals caused by epitaxial growth of ice with its (110) plane on top of the (010) surface of feldspar. Using the 3D structural models of the crystalline lattices of feldspar and ice, we suggest an interpretation of the observational data and discuss the possible implication of this phenomena for the atmospheric ice nucleation research.

UP 17: Abendvortrag von Prof. Petra Schwille

Time: Thursday 17:30–18:30 Location: H1

Evening Talk UP 17.1 Thu 17:30 H1

Lise-Meitner-Lecture: Ist Leben konstruierbar? — •Petra Schwille — Max-Planck-Institut für Biochemie, Am Klopferspitz 18, 82152 Martinsried

Obwohl uns die modernen Lebenswissenschaften und mit ihr die Biophysik täglich neue Informationen über die Moleküle und Wechselwirkungen liefern, die belebte Systeme ausmachen, können wir bis heute nicht sagen, mit welchen definierbaren Bestandteilen oder Eigenschaften die unbelebte Natur endet und die belebte beginnt. Einig ist man sich lediglich über den enormen Komplexitätsgrad des Lebens, der den anorganischer Systeme bei weitem übersteigt. Liegt der Schlüssel also in der Komplexität allein? Aber die Komplexität resultiert aus der fortwährenden Evolution, und die ersten Zellen, vor etwa 3 Milliarden Jahren, waren mutmaßlich sehr viel weniger komplex als selbst die einfachsten heutigen Organismen. Und so hoffnungslos ein Versuch wäre, „moderne“ Zellen aus ihren Bestandteilen nachzubauen - die Konzeption einer „Urzelle“ mit einem Minimum an Bauteilen und Funktionselementen scheint immerhin möglich, schließlich hat sie auch die Natur irgendwann hervorgebracht. Unser Ziel im Rahmen der Synthetischen Biologie ist es, lebende Systeme systematisch auf möglichst wenige fundamentale Funktionselemente herunter zu brechen, so dass diese Teilsysteme im Gegensatz zu den „natürlichen“ Zellen überschaubar und in Gänze verstehbar sind. Hierbei sollen zunächst verschiedene essentielle Eigenschaften lebender Systeme, wie z.B. die Selbstreplikation, mit möglichst wenigen biologischen Funktionsmodulen wie Proteinen, Nukleinsäuren und Lipiden nachgebaut und quantitativ analysiert werden. Anhand des bakteriellen Zellteilungsapparats aus *E.coli* werde ich zeigen, dass wesentliche Selbstorganisations- und Musterbildungsphänomene am Beginn der Zellteilung mit verblüffend wenigen Komponenten im Reagenzglas reproduziert werden können.