Fachverband Umweltphysik (UP)

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Übersicht der Hauptvorträge und Fachsitungen

(Vorträge: HS 5, Poster: Erdgeschoss, Plenarvortrag: HS 1, Symposium: HS 2)

Hauptvorträge

UP 1.1	Di	11:00–11:30	HS 5	**Aircraft borne combined measurements of the Fukushima radionuclide Xe-133 and fossil fuel combustion generated pollutants in the TIL - Implications for Cyclone induced rapid lift and TIL physico-chemical processes** — Hans Schlager, •Frank Arnold, Hardy Simgen, Heinfried Aufmhoff, Robert Baumann, Siegfried Lindemann, Ludwig Rauch, Frank Käther, Liisa Pirjola, Ulrich Schumann
UP 2.1	Di	14:00–14:30	HS 5	**A summary of results from laboratory ice nucleation experiments: current state of scientific understanding and parameterization developments** — •Corinna Hoose, Ottmar Möhler
UP 3.1	Di	14:30–15:00	HS 5	**Schnelle Laserabsorptions-Tomographie zur räumlich aufgelösten Bestimmung von Wasserdampfkonzentrationen** — •Anne Seidel, Steven Wagner, Volker Ebert
UP 3.4	Di	16:00–16:30	HS 5	**Variability and vertical shifts in OH Meinel emissions near the mesopause: results from SCIAMACHY on Envisat** — •Christian von Savigny, Ian McDade, Kai-Uwe Eichmann, John Burrows
UP 7.1	Mi	11:00–11:30	HS 5	**Einsatz von geophysikalischen Verfahren zur Vorhersage von Bodenparametern für die Modellierung von Bodenfunktionen** — •Peter Dietrich, Thorsten Behrens, Karsten Schmidt, Anne-Kathrin Nüsch, Claudia Dierke, Janine Krüger, Uwe Franko, Milan Kroulik, Lubos Burovka, Ulrike Werban
UP 7.2	Mi	11:30–12:00	HS 5	**Hochaufgelöste Verteilung elastischer Parameter im oberflächennahen Untergrund aus seismischen Wellenformen** — •Florian Bleibinhaus
UP 8.1	Mi	12:00–12:30	HS 5	**The Changing Arctic Ocean: Observing Consequences of the 2012 Sea Ice Minimum in the Central Arctic** — •Antje Boetius, Shipboard Science Party of Expedition IceArc
UP 13.1	Do	9:00– 9:30	HS 5	**From SCIAMACHY to the next generation of remote sensing instrumentation.** — •John Burrows
UP 14.3	Do	11:00–11:30	HS 5	**The chemistry of sprites and related plasma processes in the middle atmosphere** — •Holger Winkler

Hauptvorträge des fachübergreifenden Symposiums SYES

SYES 1.1	Do	14:00–14:30	HS 2	**Solar irradiance variability** — •Sami Solanki
SYES 1.2	Do	14:30–15:00	HS 2	**Influence of Galactic Cosmic Rays and solar variability on aerosols, clouds and climate: Results from the CLOUD experiment at CERN** — •Joachim Curtius
SYES 1.3	Do	15:00–15:30	HS 2	**NO_x - the energetic particle - climate connection?** — •Thomas Reddmann
SYES 1.4	Do	15:30–16:00	HS 2	**Impact of the solar 11-year and 27-day cycles on the Earth's middle atmosphere** — •Christian von Savigny

Fachsitzungen

UP 1.1–1.5	Di	11:00–12:30	HS 5	**Atmosphäre - Spurengase, Aerosole und Labormessungen**
UP 2.1–2.1	Di	14:00–14:30	HS 5	**Atmosphäre - Spurengase, Aerosole und Labormessungen**
UP 3.1–3.7	Di	14:30–17:15	HS 5	**Methoden - Fernerkundung, Messverfahren und Datenauswertung**
UP 4.1–4.19	Di	17:15–18:30	Poster EG	**Postersession**
UP 5.1–5.1	Mi	9:15–10:00	HS 1	**Axel Kleidon - Solar, wind and waves: Natural limits to renewable sources of energy within the Earth system**
UP 6.1–6.2	Mi	10:30–11:00	HS 5	**Boden und Agrarphysik**
UP 7.1–7.2	Mi	11:00–12:00	HS 5	**Beiträge der Deutschen Geophysikalischen Gesellschaft (DGG)**
UP 8.1–8.1	Mi	12:00–12:30	HS 5	**Ozeanographie**
UP 9	Mi	12:30–14:00	HS 5	**Mitgliederversammlung**
UP 10.1–10.4	Mi	14:00–15:30	HS 5	**Atmosphäre - Spurengase, Aerosole und Labormessungen**
UP 11.1–11.4	Mi	15:30–16:30	HS 5	**Umwelttechnologie und Hydrosphäre**
UP 12	Mi	16:45–18:15	Poster EG	**Postersession**
UP 13.1–13.3	Do	9:00–10:00	HS 5	**Methoden - Fernerkundung, Messverfahren und Datenauswertung**
UP 14.1–14.7	Do	10:00–12:30	HS 5	**Atmosphäre - Spurengase, Aerosole und Labormessungen**
UP 15.1–15.4	Do	14:00–16:00	HS 2	**Symposium Einfluss der Sonne auf das Klima der Erde**

Mitgliederversammlung des Fachverbands Umweltphysik

Mittwoch 12:30 - 14:00 HS 5
Mitgliederversammlung mit Mittagsimbiss für alle Mitglieder des Fachverbandes, Gäste willkommen

- Bericht des Vorsitzenden und Vertreters
- Wahlen
- Verschiedenes, z.B. Kommentare und Anregungen der Teilnehmer

UP 1: Atmosphäre - Spurengase, Aerosole und Labormessungen

Zeit: Dienstag 11:00–12:30 Raum: HS 5

Hauptvortrag UP 1.1 Di 11:00 HS 5

Aircraft borne combined measurements of the Fukushima radionuclide Xe-133 and fossil fuel combustion generated pollutants in the TIL - Implications for Cyclone induced rapid lift and TIL physico-chemical processes — Hans Schlager[1], •Frank Arnold[2,1], Hardy Simgen[2], Heinfried Aufmhoff[1], Robert Baumann[1], Siegfried Lindemann[2], Ludwig Rauch[2], Frank Käther[2], Liisa Pirjola[3], and Ulrich Schumann[1] — [1]DLR IPA, Oberpfaffenhofen, Germany — [2]MPI Kernphysik, Heidelberg, Germany — [3]University of Helsinki, Helsinki, Finland

The radionuclide Xe-133, released by the March 2011 nuclear disaster at Fukushima/Daiichi (hereafter FD), represents an ideal tracer for atmospheric transport. We report the, to our best knowledge, only aircraft borne measurements of FD Xe-133 in the Tropopause Inversion Layer (TIL), indicating rapid lift of polluted planetary boundary layer air to the TIL. On the same research aircraft (FALCON), we have also conducted on-line measurements of fossil fuel combustion generated pollutant gases (SO2 and other species), which had increased concentrations in the TIL. In addition, we have conducted supporting model simulations of transport, chemical processes, and aerosol processes. Our investigations reveal a potentially important impact of East-Asian cyclone induced pollutants transport to the TIL. This impact includes particularly aerosol formation.

UP 1.2 Di 11:30 HS 5

Cool and wet or coal and dry, how coal fired power generation modifies regional climate — •Wolfgang Junkermann[1,2] and Jorg M. Hacker[2] — [1]KIT, IMK-IFU, Garmisch-Partenkirchen, Germany — [2]ARA, Flinders University, Adelaide, Australia

Burning coal for power generation has environmental impact due to up to now unavoidable carbon dioxide emissions leading to global warming. A further unanticipated side effect of flue gas cleaning and reductions of sulphur and nitrogen oxide emissions is the enhancement of the production of ultrafine particles serving as cloud condensation nuclei (CCN) precursors. The number of additional CCN can modify cloud microphysics on a regional scale. Here we show first observational evidence for a large scale significant modification of rainfall spatial and temporal distribution due to power generation from state of the art 'clean' coal burning.

UP 1.3 Di 11:45 HS 5

OClO time-series in the volcanic plume of Mt. Etna, Sicily — •Jonas Gliss, Nicole Bobrowski, Marco Huwe, Constantin Mayer, Henning Finkenzeller, Leif Vogel, and Ulrich Platt — Institut für Umweltphysik, Universität Heidelberg

The study of the chemical composition of volcanic plumes is important both for the understanding of volcanic processes and the influence of volcanic activity on the atmosphere. Volcanic gas can have impacts on the atmosphere on regional and global scales. Besides very stable compounds (e.g. CO_2) also reactive halogen-species such as BrO, ClO, OClO are abundant in volcanic plumes.

The so-called method of Multiaxis Differential Absorption Spectroscopy (MAX-DOAS) is an established method to determine these reactive components in volcanic plumes by analyzing scattered sunlight which has passed the plume.

We present MAX-DOAS measurements that were performed at Mt. Etna, Sicily in September 2012. For the first time it has been possible to measure spatial distributions of the halogen compound chlorine dioxide (OClO) in a volcanic plume. Along with the evaluation of OClO the species bromine monoxide (BrO) as well as sulphur-dioxide (SO_2) were evaluated for each data set. OClO column densities up to several 10^{14} molecules/cm^2 have been measured in an area of about 4 km around the emission source. Assuming a plume width of less than 1 km this yields OClO concentrations of several hundred ppt in the volcanic plume. We will discuss these results and their importance to improve our knowledge about chlorine-chemistry in volcanic plumes.

UP 1.4 Di 12:00 HS 5

SCIAMACHY WFM-DOAS XCO_2: Improvements and Comparison with FTS Measurements — •Jens Heymann, Oliver Schneising, Maximilian Reuter, Michael Buchwitz, Heinrich Bovensmann, and John P. Burrows — University of Bremen, Institute of Environmental Physics (IUP), Bremen, Germany

Carbon dioxide (CO_2) is the most important anthropogenic greenhouse gas contributing to global climate change. Column-averaged dry air mole fractions of CO_2 (XCO_2) as retrieved from the satellite instrument SCIAMACHY on-board ENVISAT (launch 2002) have the potential to provide important missing global information on regional CO_2 surface fluxes. This however requires to satisfy challenging accuracy requirements. Here, we present results of an inter-comparison of seven years (2003 – 2009) of SCIAMACHY XCO_2 retrievals obtained with version 2.1 (WFMDv2.1) and an updated version (WFMDv2.2) of the WFM-DOAS retrieval algorithm with FTS measurements from TCCON sites. An improved cloud filtering method has been applied to the WFMDv2.2 retrievals because scattering by unaccounted clouds, especially thin cirrus clouds, is an important error source. The filter is based on a threshold technique using radiances from the saturated water vapour absorption band at 1.4 μm which is mostly sensitive to thin clouds. The inter-comparison of the SCIAMACHY WFM-DOAS XCO_2 versions with FTS measurements shows overall better agreements for WFMDv2.2. These results show that the cloud filtering method successfully improves the SCIAMACHY WFM-DOAS XCO_2 data set.

UP 1.5 Di 12:15 HS 5

Bestimmung von N2O-Druckverbreiterungskoeffizienten im 0400-Band bei 2250-2400 cm-1 und 0002-Band bei 4300-4450 cm-1 mittels hochauflösender FTIR-Spektroskopie — •Viktor Werwein[1], Anton Serdyukov[1], Jens Brunzendorf[1], Oliver Ott[1], Anne Rausch[1], Olav Werhahn[1] und Volker Ebert[1,2] — [1]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig — [2]Center of Smart Interfaces, Technische Universität Darmstadt, Petersenstraße 32, 64287 Darmstadt

Das von der PTB koordinierte europäische Forschungsprojekt "EUMETRISPEC" zielt auf die Entwicklung und Validierung eines Messstands zur rückgeführten Bestimmung molekularer Spektraldaten. Hierfür wird derzeit ein hochauflösendes FTIR-Spektrometer (Bruker IFS 125HR) charakterisiert, über Vergleichsmessungen mit hoch auflösender Laserspektroskopie validiert und um spezielle Messzellen zur präzisen Einstellung der thermo-chemischen Randbedingungen erweitert. Zielgrößen sind dabei zunächst die Linienparameter exemplarisch ausgesuchter Übergänge der wichtigsten Treibhausgase. Erste Testexperimente für das Spektrometer beschäftigten sich zunächst mit den Linienparametern der 4ν2- (2250-2400 cm-1) und der 2ν4-Bande (4300-4450 cm-1) von Distickstoffmonoxid, einem wesentlich zur Erderwärmung beitragenden Treibhausgas. Die erhaltenen Ergebnisse werden mit den Werten aus der HITRAN-Datenbank und der Literatur verglichen.

UP 2: Atmosphäre - Spurengase, Aerosole und Labormessungen

Zeit: Dienstag 14:00–14:30 Raum: HS 5

Hauptvortrag UP 2.1 Di 14:00 HS 5

A summary of results from laboratory ice nucleation experiments: current state of scientific understanding and parameterization developments — •Corinna Hoose and Ottmar Möhler — Karlsruher Institut für Technologie, Institut für Meteorologie und Klimaforschung, Karlsruhe, Deutschland

Laboratory experiments under controlled conditions with well-characterized aerosol particles are conducted by many research groups worldwide with the aim to gain new insights into the mechanism of heterogeneous ice formation. Several parameterizations of ice formation in tropospheric clouds for use in numerical models are based on these data. We present a compilation of laboratory results on hetero-

geneous ice nucleation in the deposition, condensation and immersion nucleation modes on mineral dust, soot, biological and organic particles. The data set is analysed with respect to consistent signatures, such as size or surface area dependence, ice nucleation efficiency below and close to water saturation, sensitivity to coatings or surface treatments, and composition. It is shown that a proportionality of the ice nuclei number to the particle surface area is found in immersion and condensation freezing experiments for mineral dust particles, even across different experimental methods and over a wide range of particles sizes and temperatures. Some biological particles exhibit similar ice nuclei numbers per surface area to mineral dusts, while others are significantly more active.

UP 3: Methoden - Fernerkundung, Messverfahren und Datenauswertung

Zeit: Dienstag 14:30–17:15 Raum: HS 5

Hauptvortrag UP 3.1 Di 14:30 HS 5

Schnelle Laserabsorptions-Tomographie zur räumlich aufgelösten Bestimmung von Wasserdampfkonzentrationen — •Anne Seidel[1], Steven Wagner[1] und Volker Ebert[1,2] — [1]CSI,TU Darmstadt, Petersenstr. 32, 64287 Darmstadt — [2]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig

Durch steigende Temperaturen in Gebieten mit Permafrostböden werden zunehmend klimarelevante Gase emittiert. Zur Untersuchung einer möglichen Rückkopplung der Gasemission aus den auftauenden Böden sind H_2O-Konzentrationsmessungen in der Boden-Luft-Grenzschicht von Interesse. Hierbei ist die Strukturierung der Bodenoberfläche zu berücksichtigen und deren Einfluss zu charakterisieren, wofür räumlich aufgelöste H_2O-Verteilungen benötigt werden. Das vorgestellte Diodenlaser-Absorptionsspektrometer basiert auf vier sequentiell scannenden Polygonspiegeln auf der Sendeseite und reflektierender Folie auf der anderen Seite des Messfeldes. Mittels robuster, kompakter Laser-Technologie aus der Telekommunikationsindustrie sind Feldmessungen ohne aufwändige Justierung beabsichtigt. Tunable Diode Laser Absorption Spectroscopy (TDLAS) in Verbindung mit einem schnell abtastendem optischen Aufbau liefert hierbei eine selbstkalibrierende in-situ-Messung der über die Messpfade gemittelten Konzentrationen. Es wird diskutiert, wie diese mittels tomographischer Rekonstruktionsmethoden in eine 2D-Verteilung zurückgerechnet werden können. Erste Rekonstruktionen mit simulierten Konzentrationen zeigen vielversprechende Ergebnisse und verdeutlichen das Potential des Messprinzips.

UP 3.2 Di 15:00 HS 5

Airborne wind lidar measurements in the North Atlantic in 2009 supporting ESA's Aeolus mission — •Uwe Marksteiner, Oliver Reitebuch, Stephan Rahm, Christian Lemmerz, and Benjamin Witschas — DLR-IPA, Oberpfaffenhofen, Germany

The global measurement of wind profiles is considered to be of highest priority regarding the needs for numerical weather prediction (NWP). Therefore, the European Space Agency ESA implemented the ADM-Aeolus satellite mission with a scheduled launch date in 2015. It will demonstrate the potential of the Doppler wind lidar technology for providing vertical profiles of wind globally. The wind speed measurements between 0 and about 25 km are based on laser light at 355 nm that is scattered back by aerosols/clouds and molecules. A prototype of the satellite instrument was deployed in the DLR Falcon 20 aircraft and tested during an airborne campaign over Greenland, Iceland and the North Atlantic in 2009. Additionally, a well-established second wind lidar operating at a wavelength of 2 μm was installed. Thus, the first successful flights worldwide were performed with two wind lidar instruments on-board the same aircraft using different detection principles for the wind measurement. Comparisons of the wind speeds retrieved from both lidar systems allowed the validation of the measurement principle of the satellite and the optimisation of retrieval algorithms. Measured wind fields from both lidars will be presented along with analyses from ECMWF NWP models. For the molecular and the aerosol channel of the prototype instrument, statistical comparisons yielded random errors of less than 2.5 m/s and 1.5 m/s, respectively.

UP 3.3 Di 15:15 HS 5

LED-basierte Messung von SO_2 an Vulkanen — •Henning Finkenzeller, Ulrich Platt, Denis Pöhler, Nicole Bobrowski, Adrian Herkert und Simon Herr — Institut für Umweltphysik, Universität Heidelberg

Schwefeldioxid ist ein wichtiges Spurengas unserer Atmosphäre; ein beträchtlicher Teil davon wird durch Vulkane eingetragen.

Wir entwickelten ein neuartiges in-situ Messgerät für die Bestimmung der Schwefeldioxid-Konzentration an Vulkanen. Es zeichnet sich gegenüber anderen Geräten durch Kompaktheit und geringen Energiebedarf aus; dadurch ist es für den mobilen Einsatz geeignet.

Die Messung erfolgt auf Basis der absoluten Absorptionsspektroskopie mit ultraviolettem Licht bei 285 nm. Dabei kommt eine UV-LED zum Einsatz deren Intensitätsschwankungen mit einer Kontrolldiode überwacht werden. Die Praktikabilität der Messmethode wurde in Laboruntersuchungen sowie im Feldeinsatz 2012 am Vulkan Etna bestätigt. Grundsätzlich kann das Messprinzip auch zur Bestimmung von Konzentrationen anderer Spurengase, so zum Beispiel Ozon, herangezogen werden.

Mit dem neuen Konzept kann zukünftig eine einfachere und flächendeckendere Datennahme erfolgen und dadurch genauere Erkenntnis über Vulkane erlangt werden. Auch Flugzeuggebundene Messungen, z.B. in einer Vulkanfahne, sind damit möglich.

Kaffeepause, 30 min

Hauptvortrag UP 3.4 Di 16:00 HS 5

Variability and vertical shifts in OH Meinel emissions near the mesopause: results from SCIAMACHY on Envisat — •Christian von Savigny[1], Ian McDade[2], Kai-Uwe Eichmann[3], and John Burrows[3] — [1]Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Germany — [2]Centre for Research in Earth and Space Science (CRESS), York University, Toronto, Ontario, Canada — [3]Institut für Umweltphysik, Universität Bremen, Bremen, Germany

One of the standard techniques to remotely sense mesopause temperatures from the ground is based on spectroscopic measurements of vibrational-rotational emission bands of the OH molecule. Temporal and spatial variability of the altitude and shape of the OH emission layer complicates the interpretation of the temperature records. In this study we use SCIAMACHY/Envisat measurements of different OH emission bands to (a) characterize the spatial and temporal variability of the OH emission altitude, (b) investigate possible altitude shifts between OH bands originating from different vibrational levels. Evidence for systematic vertical shifts is presented, and is shown to be consistent with model simulations. The importance of quenching by atomic oxygen for the vertical shifts is demonstrated based on SCIAMACHY measurements. The SCIAMACHY data record shows no evidence for significant long-term or solar cycle variations of the annually averaged OH emission altitudes.

UP 3.5 Di 16:30 HS 5

In-Situ Turbulenzmessungen in der Stratosphäre mit LITOS — •Andreas Schneider, Anne Theuerkauf, Michael Gerding und Franz-Josef Lübken — Leibniz-Institut für Atmosphärenphysik, Kühlungsborn, Deutschland

Obwohl die Stratosphäre meist stabil geschichtet ist, finden dort Brechung von Schwerewellen und damit verbunden Turbulenz und Dissipation statt. Diese beeinflussen den Energietransport von der Troposhäre zur Mesosphäre. Stratosphärische Turbulenz ist darüber hinaus für den Transport von Spurenstoffen von Bedeutung.

Zur genauen Bestimmung von Turbulenzparametern muss die innere Skala aufgelöst werden, welche in der Stratosphäre im Bereich von Zentimetern und darunter liegt. Dies ist nur mit In-Situ-Messungen möglich. Unser ballongetragenes System LITOS (Leibniz Institute Turbulence Observations in the Stratosphere) nutzt Konstant-Temperatur-Anemometer (CTA) und Konstant-Strom-Anemometer (CCA), um kleinskalige Fluktuationen in Wind und Temperatur mit hoher Auflösung (< 1 mm) simultan zu messen.

Bislang wurden drei Flüge von Kiruna, Schweden (68°N, 21°O) sowie weitere Flüge mit kleinerer Nutzlast von Kühlungsborn (54°N, 12°O) und Sodankylä (67°N, 27°O) aus durchgeführt. Dabei wurden turbulente Schichten von mehreren 10 m Dicke beobachtet, welche

durch ruhige Bereiche getrennt sind. Energiedissipationsraten können direkt aus den Spektren berechnet werden. Die Werte schwanken in der Größenordnung 10^{-7} bis 1 W/kg. Die Ergebnisse werden im Rahmen der atmosphärischen Hintergrundsituation diskutiert.

UP 3.6 Di 16:45 HS 5

GRACE Follow-On Laser Ranging Interferometer — •Vitali Müller, Benjamin Sheard, Daniel Schütze, Gunnar Stede, Oliver Gerberding, Christoph Mahrdt, Gerhard Heinzel, and Karsten Danzmann — Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Universität Hannover, Callinstr. 38, 30167 Hannover

The joint NASA/DLR satellite pair GRACE (Gravity Recovery and Climate Experiment) has been measuring temporal and spatial variations of the geopotential since 2002. These maps of Earth's gravity field are recovered from inter-satellite distance variations and they change due to the re-distribution of Earth's mass by various geophysical effects including tides, mantle conversion or melting glaciers. Therefore, the data has a wide field of applications in geoscience.

Since the mission lifetime is drawing to an end, a GRACE follow-on mission is being developed for launch in 2017. In addition to the conventional microwave ranging system a inter-satellite laser link will be established to perform interferometric distance measurements with a precision of 80 nm/sqrt(Hz) at 100 mHz. An overview of the follow-on mission will be given, focusing on the laser ranging instrument, which will be the first inter-satellite laser ranging interferometer in Space.

UP 3.7 Di 17:00 HS 5

Penalisierte funktionale Regression mit skalarer Zielgröße unter Einführung eines Kovariablen-Interaktionsterms als Sensorauswertestrategie. — •Karen Fuchs[1], Sonja Greven[1], Fabian Scheipl[1] und Evamaria Stütz[2] — [1]Department of Statistics, LMU Munich, Ludwigstr. 33, 80539 Munich, Germany — [2]Siemens AG, Corporate Technology, Otto-Hahn-Ring 6, 81739 Munich, Germany

Der Einsatz verschiedenster Sensoren nimmt seit Jahren zu. Dabei wird erwartet, dass der Informationsgehalt der aus den Sensoren gewonnen Signale steigt, während Erzeugungskosten und Größe minimiert werden. Diese kontroversen Ziele können insbesondere bei komplexen Systemen nicht immer mittels konventioneller Signalverarbeitung erreicht werden, sie erfordern angepasste Auswertemethoden. Hier wird eine Methode aus der statistischen Regressionsanalyse, basierend auf funktionalen Daten, vorgestellt. Dabei wird die Schätzung der Regressionsfunktionen über Basiserweiterung und die Maximierung der penalisierten log-likelihood Funktion des betrachteten Modells mit skalarer Zielgröße um einen Kovariablen-Interaktionsterm erweitert. Dieser gibt Aufschluss über einen möglichen zusätzlichen Informationsgehalt durch die Analyse von Interaktionen zwischen simultan gemessenen Sensorsignalen. Außerdem kann die Regressionsfläche des Interaktionsterms Aufschlüsse über verdeckte Mechanismen im untersuchten System geben. Anhand eines Zellchipsensors werden die Methode illustriert und erste Ergebnisse interpretiert.

UP 4: Postersession

Zeit: Dienstag 17:15–18:30 Raum: Poster EG

UP 4.1 Di 17:15 Poster EG

Measurements for PV-Module outdoor performance — •Jörg Bendfeld — Universität Paderborn, KET, Pohlweg 55, 33098 Paderborn

Reliability and energy yield are the main parameter of interest concerning PV modules. For this reason, long-term PV module tests are carried out to give site-specific reports about the module performance. Unlike laboratory measurements long-term outdoor measurements are not repeatable. But those measurements are the best way to compare the energy yields of different module types under varying weather conditions. In the interests of customers and of the industry, PV laboratories perform long-term outdoor tests. Performing PV outdoor tests should last over a period of at least one year. The equipment for basic energy yield measurements records at least ambient temperature, module temperature, and irradiance in the module plane (plane of array); current and voltage measurements are taken at the maximum power point (MPP). The recording time interval is 5 seconds. This is a compromise between precision and applicability. The ambient weather data and the condition data for any module have to be collected and evaluated.

UP 4.2 Di 17:15 Poster EG

Foundation monitoring for offshore windfarms — •Jörg Bendfeld[1] and Jens Krieger[2] — [1]Universität Paderborn, KET, Pohlweg 55, 33098 Paderborn — [2]Airwerk GmbH, Industriering 14 49393 Lohne

The offshore wind energy industry is still relatively young. There is little or simply not really sufficient experience regarding the safety of the wind turbine foundations; the material stress due to wind and waves is still not completely clear. A continuous foundation monitoring including analysis is therefore needed. A foundation monitoring includes: -*scour monitoring, -*grout monitoring, -*inclination monitoring, -*load monitoring, -*acceleration monitoring, -*monitoring of turbine position, -*metocean sensors. There is not yet a standard concerning the scope of offshore foundation monitoring projects. Realization details depend on wind park project specifics such as foundation type, water depth, soil conditions, etc.

UP 4.3 Di 17:15 Poster EG

Towards traceability in line parameter measurement of CO2 and H2O at 2.7 micrometer by tunable diode laser absorption spectroscopy — •Javis Nwaboh[1], Andrea Pogány[1], Olav Werhahn[1], and Volker Ebert[1,2] — [1]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig — [2]Center of Smart Interfaces, Technische Universiät Darmstadt, Petersenstr. 32, 64287 Darmstadt

Carbon dioxide (CO2) and water vapor (H2O) are important molecules for environmental monitoring. Line strengths and collision broadening coefficients of these species are often used in environmental monitoring and climate modeling; therefore, precise knowledge of these line data is becoming indispensible. Line data retrieved by different spectroscopic techniques are collected in databases such as HITRAN and GEISA. These databases are very useful to the environmental monitoring community. However, the traceability of line data to the SI system of units and uncertainty assessments are often incomplete or missing in the literature. We present measurements of line strengths and broadening coefficients, of single CO2 and H2O lines in the absorption bands around 2.7 micrometer, using tunable diode laser absorption spectroscopy (TDLAS). We provide a GUM-compliant uncertainty assessment for the measured line data and address traceability to the SI units. The relative uncertainties of our line strengths and broadening coefficients are in the 2 and 0.8 % range, respectively. This work has been initiated within the projects MACPoll and GAS, jointly funded by the EMRP participating countries within EURAMET and the EU.

UP 4.4 Di 17:15 Poster EG

BrO/SO_2 Verhältnisse an Vulkanen vom NOCAC Netzwerk: — •Peter Lübcke, Nicole Bobrowski, Leif Vogel und Ulrich Platt — Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg

Das Verhältnis von Halogenen zu Schwefel in Vulkangasen ist ein Indikator für dynamische Veränderungen im oberen Teil eines Vulkansystems. Erst kürzlich wurde das Verhältnis von Brommonoxid (BrO) zu Schwefeldioxid (SO_2) als Indikator für Veränderungen in der Vulkanaktivität vorgeschlagen. Dieses Verhältnis kann durch Fernerkundungsmessungen mit Differentieller Optischer Absorptions Spektroskopie im UV gemessen werden. Das BrO Radikal wird jedoch nicht direkt von Vulkanen emittiert, vermutlich wird Brom in Form von Bromwasserstoff emittiert und zum Teil durch photochemische Prozesse in der Atmosphäre zu BrO oxidiert. Wir stellen Messungen von BrO/SO_2 Verhältnissen die vom "Network for Observation of Volcanic and Atmospheric Change"(NOVAC) gemessen wurden. NOVAC hat insgesamt 64 Spektrometer an 24 Vulkanen weltweit installiert, von denen einige seit 7 Jahren kontinuierlich vulkanische Gasemissionen messen. Wir zeigen, dass es mit den Geräten, die im Rahmen des NOVAC Netzwerkes zur SO_2 Überwachung installiert wurden, möglich ist BrO/SO_2 Verhält-

nisse zu bestimmen und stellen erste Zeitreihen vor. Dieser große Datensatz erlaubt es Änderungen im BrO/SO_2 Verhältnis im Hinblick auf Zusammenhänge mit verschiedenen möglichen Einflussfaktoren zu untersuchen. Hierbei sind insbesondere die Meteorologie, das Fahnenalter in der Atmosphäre und die Vulkanaktivität interessant.

UP 4.5 Di 17:15 Poster EG

Application of DOAS Instruments for Trace Gas Measurements on Unmanned Aerial Systems — •Martin Horbanski[1,2], Denis Pöhler[1], Tobias Mahr[1,2], Thomas Wagner[1,2], and Ulrich Platt[1] — [1]Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg — [2]Max-Planck-Institut für Chemie, Hahn-Meitner-Weg 1, 55128 Mainz

Unmanned Aerial Systems (UAS) are a new powerful tool for observations in the atmospheric boundary layer. Recent developments in measuring technology allow constructing compact and sensitive DOAS instruments which can fit the space and weight constraints on UAS. This opens new possibilities for trace gas measurements in the lower troposphere, especially in areas which are not accessible to manned aviation e.g. volcanic plumes or which should be monitored regularly (e.g. industrial emissions of a stack).

A passive DOAS instrument for the APAESO Platform, a medium size UAS, is presented. It is equipped with telescopes for observations in downward and horizontal viewing direction. Thus it allows determining height profiles and spatial distributions of trace gases. For this the light is analyzed by a compact spectrometers which cover the UV-blue range allowing to measure a broad variety of atmospheric trace gases (e.g. NO2, SO2, BrO, IO, ...). Additionally, the nadir direction is equipped with a VIS-NIR spectrometer. It is used to measure and analyse reflection spectra of different types of vegetation. These will serve as references for satellite measurements. The instrumental setup and the results of first test flights are shown.

UP 4.6 Di 17:15 Poster EG

Decadal trends in ozone, bromine monoxide, and nitrogen dioxide from SCIAMACHY limb measurements and multi-instrument comparisons — •Claus Gebhardt[1], Alexei Rozanov[1], René Hommel[1], Mark Weber[1], John P. Burrows[1], Doug Degenstein[2], Lucien Froidevaux[3], and Anne M. Thompson[4] — [1]University of Bremen, Institute of Environmental Physics, Bremen, Germany — [2]University of Saskatchewan, Saskatoon, Canada — [3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA — [4]Department of Meteorology, Pennsylvania State University, Pennsylvania, USA

The SCIAMACHY/ENVISAT satellite instrument (2002-12) has monitored Earth' atmosphere globally for almost one decade. In its limb viewing geometry, it recorded vertical profiles of the atmospheric limb scatter. O_3, BRO, and NO_2 are among the retrieved species. Their vertical profiles are obtained in 1 km altitude steps. Longterm changes as well as periodically varying features are present in their time series. The longterm changes are statistically described by trends. The trend profiles of SCIAMACHY limb ozone extend throughout the stratosphere.

In our talk, we compare trend profiles of stratospheric O_3 from SCIAMACHY to other measurements ranging from contemporary satellite instruments to different measurement techniques. We further present trend profiles of BRO and NO_2. Being crosslinked through chemical reactions, there are relations between the trend profiles of O_3, BRO, and NO_2.

UP 4.7 Di 17:15 Poster EG

Spectral Soft Calibration for use in Conjunction with an Optimal Estimation based Approach to Retrieve O3 Stratospheric Profiles from SCIAMACHY UV Measurements in the Hartley and Huggins Band — •Stefan Bötel, Mark Weber, Alexei Rozanov, and John P. Burrows — Institute of Environmental Physics, University of Bremen, Germany

Stratospheric profile retrieval of ozone in the Hartley-Huggins band in nadir viewing geometry is one of very few options of obtaining a far-reaching timeseries of ozone profiles. The underlying optimal estimation approach coupled with the specific O3 absorption spectrum in the UV wavelength region lead to the need for a very exact spectral calibration. SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric ChartographY) launched on ENVISAT in March 2002 measures sunlight, transmitted, reflected and scattered by the earth atmosphere or surface (240 nm - 2380 nm) in both nadir and limb viewing geometry. With its long lifetime of close to 10 years and its overlap with both GOME on ERS-2 and GOME II on MetOp it is a good candidate for the start of such a long time series. In order to counter instrument dependant effects and degradation a spectral calibration is neccessary. In this study a possible method for in-flight calibration by means of comparison of measured and simulated reflectance spectra will be shown. The basis for simulated spectra are refernce regions over various latitudes with simulations carried out with SCIATRAN. Such an instrument independant calibration technique can improve the comparability of datasets from different intruments.

UP 4.8 Di 17:15 Poster EG

Limb and Nadir detection of UV/vis/near IR absorbing trace gases from the novel research aircraft HALO around the tropopause and in the troposphere. — •Tilman Hüneke[1], Eric Gentry[2], Mareike Kenntner[1], Sabrina Ludmann[1], Rasmus Raecke[1], and Klaus Pfeilsticker[1] — [1]Institut für Umweltphysik, Universität Heidelberg, Heidelberg, Germany — [2]Massachusetts Institute of Technology, Cambridge, USA

A novel 6-channel mini-DOAS optical spectrometer has been deployed on the novel HALO research aircraft. It is aiming at high sensitive measurements of profiles of O3, NO2, CH2O, C2H2O2, BrO, OClO, IO, gaseous, liquid and solid H2O around flight altitude. The Nadir observation also allows to measure the total tropospheric column of these gases. Upon the retrieval of slant column amounts of the targeted gases, the data reduction involves forward radiative transfer modelling of the observations and standard mathematical inversion technique. For the first time, the novel spectrometer has been deployed on the HALO research aircraft during TACTS (Transport And Composition in the UT/LMS) and ESMVal (Earth System Model Validation) measurement campaigns which took place in summer 2012. The present contribution reports on technical features of the novel instrument, the feasibility of the method together with some first sample results for major absorbers.

UP 4.9 Di 17:15 Poster EG

Influence of antifreeze proteins on the crystal growth in solidification of water — •Bernd Kutschan[1], Silke Thoms[2], Klaus Morawetz[1,3,4], and Sibylle Gemming[5] — [1]Münster University of Applied Sciences, Stegerwaldstrasse 39, 48565 Steinfurt, Germany — [2]Alfred Wegener Institut, Am Handelshafen 12, D-27570 Bremerhaven, Germany — [3]International Institute of Physics (IIP), Avenida Odilon Gomes de Lima 1722, 59078-400 Natal, Brazil — [4]Max-Planck-Institute for the Physics of Complex Systems, 01187 Dresden, Germany — [5]Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden-Rossendorf, P.O. Box 51 01 19, 01314 Dresden, Germany

Antifreeze proteins (AFPs) are surface-active molecules and inhibit the ice crystal growth during the freezing process. They interact with the diffuse water/ice interface and prevent a complete solidification by freezing. Microstructures evolve as a result of the phase separation in the presence of AFPs. The thermodynamics of pure water-ice phase transition is modified by the inhibitory effect of AFPs on ice formation as a kinetic phenomenon in non-equilibrium. Different hypotheses exist on the detailed mechanisms of the AFPs. Particularly with regard to the modification of the surface tension we are able to compute the interfacial energy from kink solutions. Connecting phase-field methods with reaction kinetics, the "adsorption-inhibition" theory of Langmuir seems to be suited to verify the microstructure formation in sea ice.

UP 4.10 Di 17:15 Poster EG

In situ characterization of mixed phase cloud ice particles. — •Paul Vochezer, Martin Schnaiter, Ahmed Abdelmonem, and Thomas Leisner — Karlsruhe Institute of Technology IMK-AAF, Germany

Clouds alter the Earth's radiative properties and are a major component of the hydrological cycle. A common cloud type in mid-latitudes are mixed phase clouds which contain both ice particles and water droplets. The state of the ice phase is of great importance to the lifetime and the radiative properties of mixed phase clouds. In order to characterize cloud particles in number, size, phase and morphology we deployed a set of three instruments during a cloud chamber campaign (AIDA-RICE01) and a field campaign (CLACE2013). The Small Ice Detector (SID) and the Particle Phase Discriminator (PPD) generate high resolution scattering patterns of individual cloud particles from which the particles size, phase and morphology can be inferred. During CLACE2013 the PPD was operated as part of the novel Ice Selective Inlet (ISI) which was constructed in close cooperation at PSI, Switzer-

land. The ISI selectively samples ice particles from mixed phase clouds and thus allows for a highly detailed analysis of the ice phase particles with the PPD. The Particle Habit Imaging and Polar Scattering instrument (PHIPS) records both real images and the scattering phase function of individual cloud particles. The PHIPS data complements the output of the other instruments. First ice particle microphysics results from the AIDA-RICE01 and CLACE2013 campaign are presented.

UP 4.11 Di 17:15 Poster EG

Optimierung der Nah-IR DOAS Messung durch den Einsatz neuer Modenmischer — •Jan-Marcus Nasse, Denis Pöhler und Ulrich Platt — Institut für Umweltphysik, Universität Heidelberg

Die Differentielle Optische Absorptions Spektroskopie (DOAS) ist eine im UV und VIS Spektralbereich seit langem sehr erfolgreich angewandte, kalibrationsfreie Messmethode zur Fernerkundung zahlreicher Spurenstoffe. Die Ausweitung auf den Nah-IR Spektralbereich (bis ca. 2000 nm) und somit die Messung von interessanten Spurenstoffen wie Methan und Kohlendioxid ist durch die Verfügbarkeit entsprechender Detektorzeilen seit einiger Zeit theoretisch möglich. Allerdings wurde hierbei meist eine für DOAS nicht zufriedenstellende Messgenauigkeit erreicht.

Ursache dafür ist eine fehlende gleichmäßige Ausleuchtung des Spektrographen. Zur homogenen Mischung des empfangenen Lichtsignals wird es durch Quarz-Lichtwellenleiter zum Spektrographen geleitet, wobei sich Fasermoden ausbilden. Für Anwendungen im Nah-IR hat eine unzureichende Mischung dieser Moden erfolgreiche Atmosphärenmessungen bisher verhindert.

Durch den Einsatz von Modenmischern, die mechanisch auf die Faser einwirken, kann das optische Rauschen aufgrund von Fasermoden reduziert werden. Im UV- und sichtbaren Spektralbereich wird diese Modenmischung seit längerem erfolgreich angewandt. Im Nah-IR haben sich die bisherigen Methoden als nicht ausreichend erwiesen. Wir stellen zwei neue Entwürfe zur Modenmischung vor, mit denen das optische Rauschen im Nah-IR um bis zu 85 % reduziert wird.

UP 4.12 Di 17:15 Poster EG

Temperature effects in MAX-DOAS observations of NO_2 — •Andreas Richter, Folkard Wittrock, Enno Peters, Anja Schönhardt, and John P. Burrows — Institute of Environmental Physics, University of Bremen, Bremen, Germany

Multi Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) measurements are often applied to the observation of atmospheric NO_2. The method is based on absorption spectroscopy and uses the absorption cross-section of NO_2 to identify and quantify its amounts in the troposphere and stratosphere. As NO_2 has a temperature dependent absorption cross-section, atmospheric temperature impacts on the observed signal.

In this study, the effects of the temperature dependence of the NO2 absorption cross-section on MAX-DOAS measurements of stratospheric and tropospheric NO_2 are discussed and the errors introduced by current retrieval approaches are discussed.

Using data from the CINDI campaign, it is then investigated in how far the temperature dependence of the NO_2 signal can be exploited to derive a tropospheric NO_2 column from zenith-sky observations alone, and the results are compared to those obtained from off-axis measurements.

Based on a similar approach, the applicability of the temperature signal for correction of stratospheric observations in polluted places such as Bremen is evaluated by applying a modified Langley Plot method to zenith-sky observations at twilight.

UP 4.13 Di 17:15 Poster EG

SO_2 Kamera Messungen an Stromboli und Etna — •Marco Huwe[1], Nicole Bobrowski[1], Peter Lübcke[1], Julian Wittmer[1], Giancarlo Tamburello[2], Tom Pering[3] und Ulrich Platt[1] — [1]Institute of Environmental Physics, University of Heidelberg — [2]Dipartimento DiSTeM, Università di Palermo, Italy — [3]Department of Geography, University of Sheffield, UK

Die Analyse von Vulkanemissionen ist seit vielen Jahren eine wichtige Methode in der Vulkanologie. Besonders SO_2, mit einer starken Absorption im UV und einem im Vergleich zur restlichen Atmosphäre hohen Vorkommen in Vulkanfahnen, ist durch optische Techniken gut nachweisbar. Unser Instrument misst die 2D-Verteilung von SO_2 mit Hilfe von 2 Interferenzfiltern. Diese arbeiten im spektralen Bereich schwacher SO_2 Absorption bei 330nm und starker Absorption bei 310nm mit einer Bandbreite von 10nm. Mit einer zeitlichen Auflösung im Sekundenbereich können wir mit diesen Messungen absolute SO_2 Flüsse bestimmen.

Diese Arbeit präsentiert Ergebnisse von SO_2-Kamera-Messungen am Etna und Stromboli, welche durch Ergebnisse von simultan durchgeführten in-situ Messungen ergänzt werden. Des weiteren wurde am Etna mit zwei unterschiedlichen SO_2 Kamera Systemen Daten erhoben. Diese Daten wurden mit zwei unterschiedlichen etablierten Auswertealgorithmen ausgewertet. Ein Vergleich der erzielten Ergebnisse und deren Unterschiede wird vorgestellt und diskutiert.

UP 4.14 Di 17:15 Poster EG

Consistency of CO retrievals between the global networks NDACC and TCCON — •Christof Petri, Thorsten Warnecke, Mathias Palm, Nick Deutscher, and Justus Notholt — Institute of Environmental Physics, University of Bremen, Bremen, Germany

The Network for the Detection of Atmospheric Composition Change (NDACC) and the Total Carbon Column Observing Network (TCCON) are the two leading networks for groundbased atmospheric FTIR measurements of tracegases. NDACC was established to ob- serve stratospheric tracegases, later the activities were extended to the complete atmosphere. TCCON is specialised in the observation of greenhouse gases. While NDACC is measuring in the middle infrared with a resolution of 0.005 wavenumbers, TCCON uses the near infrared spectral region and a resolution of 0.02 wavenumbers. The retrieval strategies in these different spectral regions are examined for interfering gases and compared in precision. The retrieval programs gfit and sfit are used.

The measurements have been performed in Bremen using a Bruker 125HR interferometer which is part of both, the TCCON and the NDACC network.

This study is performed within the Demonstration Network Of ground-based Remote Sensing Observations (NORS), support by the European Commission within the 7th Framework Program.

UP 4.15 Di 17:15 Poster EG

Tropospheric trace gas mapping by airborne imaging DOAS — •Anja Schönhardt, Patricia Altube, Andreas Richter, Sven Krautwurst, Konstantin Gerilowski, and John P. Burrows — Institut für Umweltphysik, Universität Bremen

Aircraft remote sensing measurements are a valuable tool for measurements and mapping of tropospheric trace gases. The presented imaging DOAS instrument is specifically built for airborne applications and is used for observations of anthropogenic nitrogen dioxide, NO_2.
Viewing in nadir geometry, tropospheric column amounts of the retrieved trace gases are determined. Radiation from within about 50 degrees opening angle across track is recorded simultaneously. Taking the aircraft position angles into account, the geolocation of each individual observed scene is corrected and thus determined with high accuracy. Spectral and spatial resolution of the instrument is of good quality and allows trace gas mapping on a spatial sale of 100m.
The determination of NO_2 emission fluxes from a power plant exhaust plume is performed based on the Gaussian plume model. Results from research flights covering different areas with anthropogenic pollution sources are presented.

UP 4.16 Di 17:15 Poster EG

Greenhouse gas measurements with Fourier Transform Spectroscopy on Ascension Island — •Dietrich G. Feist and Sabrina Niebling — Max Planck Institute for Biogeochemistry, Jena, Germany

The Total Carbon Column Observing Network (TCCON) consists of several sites that measure greenhouse gases like CO_2, CH_4, CO, and N_2O across the globe. Each site has a Fourier Transform Spectrometer (FTS) that combines a large bandwith with a high spectral resolution. The instruments use the sun as a light source and retrieve the total column concentrations of the greenhouse gases. They augment the existing network of ground based in-situ measurements and provide a valuable reference for satellite measurements.

The latest TCCON station is the FTS operated by the Max Planck Institute for Biogeochemistry in Jena, Germany, on the remote Ascension Island. It is the only equatorial station so far.

The poster provides details on the many challenges that have to be overcome to operate an automatic instrument in such a remote place. It also shows comparisons with existing data from in-situ observations, satellite measurements and global transport model calculations.

UP 4.17 Di 17:15 Poster EG

Washout Coefficients for Particle Bound Radionuclides in Rain and Snow Events — •Felix Bernauer, Kerstin Huerkamp, and Jochen Tschiersch — Helmholtz Zentrum München, Department of Radiation Sciences, Munich, Germany

For the removal of particle bound radionuclides and aerosol particles in general wet deposition processes play a key role. Supposing that wet deposition depends strongly on the type and characteristics of the precipitation event we present field experiments on the quantification of wet deposition of radionuclides by snowfall and rain events. The experiments take place in the free atmosphere at the Environmental Research Station Schneefernerhaus on Mt. Zugspitze (2650m a.s.l.). Snowfall event characterization, quantification of the washout of aerosol particles in the size range from $10^{-2}\mu$m to 10μm and determination of the overall activity washout coefficient for the radionuclides ^{7}Be, ^{137}Cs and ^{210}Pb are the key tasks in our experiments. A 2D Video-Distrometer (Joanneum Research), a high volume aerosol sampling station ASS1000 (Fischer, PTI), an electrical low pressure cascade impactor ELPI+ (Dekati) and a low-level background gamma spectrometer (Canberra Broad Energy Germanium Detector) make these parameters accessible and software tools for data handling and processing will be developed. First results on precipitation event characterization are shown. Relating the radioactivities in the freshly fallen snow and rain to those in the collected aerosol allows us to quantify the washout efficiency for different precipitation events.

UP 4.18 Di 17:15 Poster EG

Comparison of middle and near infrared total column xCO_2 retrieval — •Matthias Buschmann[1], Nicholas Deutscher[1,3], Susanne Dohe[2], Vanessa Sherlock[4], David Griffith[3], and Justus Notholt[1] — [1]Institute of Environmental Physics, University of Bremen, Bremen, Germany — [2]Institute for Meteorology and Climate Research (IMK-ASF), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [3]School of Chemistry, University of Wollongong, Wollongong, Australia — [4]National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand

Monitoring networks like the NDACC (Network for the Detection of Atmospheric Composition Change) and TCCON (Total Carbon Column Observing Network) continuously monitor a variety of trace gases in the atmosphere by employing ground based Fourier Transform InfraRed (FTIR) spectroscopy on solar radiation. TCCON uses near infrared (NIR) spectral windows to retrieve total column CO_2, which yield a high enough precision ($< 0.2\%$) to use as validation for satellite retrievals and model data. On the other hand, it has been considered difficult to obtain results with comparable precision from the middle infrared (MIR) from NDACC spectra. It would, however, be useful to be able to use the longer time series of the NDACC stations. Here we present an intercomparison study using different monitoring stations, that routinely take both NIR and MIR spectra. This results in a validation scheme for a MIR time series based on the already well validated TCCON data.

UP 4.19 Di 17:15 Poster EG

Retrieval of tropospheric ozone columns from SCIAMACHY limb-nadir matching observations — Felix Ebojie[1], Christian von Savigny[1,2], •Annette Ladstätter-Weissenmayer[1], Alexei Rozanov[1], Mark Weber[1], Stefan Bötel[1], Heinrich Bovensmann[1], and John Burrows[1] — [1]Institute of Environmental Physics (IUP), University of Bremen, P.O. Box 330440, D-28334 Bremen, Germany — [2]Institut für Physik , Felix-Hausdorff-Str. 6, Ernst-Moritz-Arndt-Universität Greifswald 17487 Greifswald

Satellite observations of tropospheric ozone are of critical importance in obtaining a global and more thorough knowledge of the phenomena affecting air quality. Tropospheric ozone has a significant adverse effect on the climate system. In the lower troposphere, during summer, it is a major constituent of photochemical smog and excess of it is toxic to the ecosystem, animal and man. It is equally known as a major oxidant and also involved in the production of other oxidants such as hydroxyl (OH) radicals. In the middle and upper troposphere, ozone acts as a greenhouse gas. The retrieval of tropospheric ozone from UV/VIS/NIR satellite spectrometer such as the Scanning Imaging Absorption spectroMeter for Atmospheric CHartographY (SCIAMACHY) instrument onboard the ESA satellite Envisat is difficult because only about 10 % of the Total Ozone Column (TOC) is in the troposphere. In this analysis we present the retrieval of tropospheric ozone columns from SCIAMACHY limb-nadir matching observations.

UP 5: Axel Kleidon - Solar, wind and waves: Natural limits to renewable sources of energy within the Earth system

Zeit: Mittwoch 9:15–10:00 Raum: HS 1

Plenarvortrag UP 5.1 Mi 9:15 HS 1

Solar, wind and waves: Natural limits to renewable sources of energy within the Earth system — •Axel Kleidon — Max-Planck-Institute for Biogeochemistry, Jena, Germany

Renewable sources of energy, such as solar, wind, wave, or hydropower, utilize energy that is continuously generated by natural processes within the Earth system from the planetary forcing. Here we estimate the limits of these natural energy conversions and the extent to which these can be used as renewable energy sources using the laws of thermodynamics. At most, wind power in the order of 1 000 TW (1 TW = 1E12 W) can be derived from the total flux of incoming solar radiation of 175 000 TW, which is consistent with estimates based on observations. Other generation rates that are derived from the kinetic energy of wind are in the order of 10 - 100 TW. In comparison, the human primary energy demand of about 17 TW constitutes a considerable fraction of these rates. We provide some further analysis on the limits of wind power using a combination of conceptual models, observational data, and numerical simulation models. We find that many current estimates of wind power substantially overestimate the potential of wind power because the effect of kinetic energy extraction on the air flow is neglected. We conclude that the only form of renewable energy that is available in substantial amounts and that is associated with minor climatic impacts is solar power.

UP 6: Boden und Agrarphysik

Zeit: Mittwoch 10:30–11:00 Raum: HS 5

UP 6.1 Mi 10:30 HS 5

Flächenintegrierte Messung der Bodenfeuchtedynamik mittels Detektion von natürlichen Neutronen — •Sascha Oswald, Carlos Rivera Villarreyes und Gabriele Baroni — Inst. für Erd- und Umweltwissenschaften, Universität Potsdam, 14476 Potsdam

Eine neue Methode, mittels Neutronensonden die Fluktuationen der vom Boden ausgehenden Hintergrundsstrahlung zu messen, das 'Ground Albedo Neutron Sensing', kann einen Beitrag zur Bestimmung von Bodenfeuchteänderungen mit neuartigem Charakter liefern. Sie zielt auf die zeitliche Veränderung eines mittleren Wassergehalts auf Größe einiger ha Fläche, und zwar bis in etwa eine Tiefe von 50 cm. Mit mehreren solcher Messungen können unterschiedliche Teilgebiete eines Einzugsgebiets parallel erfasst werden. Die Methode basiert auf den Neutronen, die durch natürliche Höhenstrahlung im Boden moderiert werden und diesen nach ober verlassen. Deren Anzahl wird stark vom totalen Wassergehalt des Bodens beeinflusst, aber auch von anderen Größen wie einfallende kosmische Höhenstrahlung, Schneedecke, Vegetation, im Boden gebundener Wasser- und Kohlenstoff.

Eigene Untersuchungen haben gezeigt, dass der Zusammenhang zwischen Neutronenzählrate sich in mittlere Bodenfeuchtewerte umsetzen lässt, die mit Vergleichsmessungen vor Ort übereinstimmen. Allerdings gibt es u.a. einen zeitlich veränderlichen Einfluss der Vegetation. Da-

neben gibt es unterschiedliche methodische Ansätze. Neben diesen offenen Punkten zeigt sich jedoch das Potential solcher Messdaten, hydrologische Modelle und speziell die Bodenwasserbilanz zu verbessern.

UP 6.2 Mi 10:45 HS 5

Analyse von Edelgaskonzentrationsschwankungen in Bodenluft und Grundwasser — •Simon Mayer[1], Florian Freundt[2] und Werner Aeschbach-Hertig[3] — [1]smayer@iup.uni-heidelberg.de — [2]florian.freundt@iup.uni-heidelberg.de — [3]aeschbach@iup.uni-heidelberg.de

In der vorgestellten Studie wird der Einfluss von Bodenatmung und der hierbei auftretenden Sauerstoffzehrung auf Edelgasgehalte der Bodenluft und des Grundwassers untersucht, insbesondere im Hinblick auf die Bestimmung von Edelgastemperaturen (NGTs). Hierfür wurden zwei Messstellen eingerichtet, um Bodenluft aus verschiedenen Tiefen zwischen der Erdoberfläche und dem Grundwasserspiegel regelmäßig zu beproben. Da in fast allen beprobten Bodentiefen jegliche Abnahme der Sauerstoffkonzentration durch eine entsprechende Zunahme von CO2 kompensiert wird, war kein Anstieg der Edelgaspartialdrücke zu erwarten. Dennoch ist in allen beprobten Tiefen seit Frühjahr 2012 ein signifikanter Anstieg der Edelgaskonzentrationen über das atmosphärische Level hinaus beobachtbar. Dies lässt weitere und einflussreichere Einflüsse als Sauerstoffzehrung auf Edelgaspartialdrücke in der Bodenluft vermuten. Eine solche Ursache könnte Stickstofffixierung sein. Die Ergebnisse einer NGT-Modellierung zeigen keine Anzeichen für erhöhte Edelgasgehalte des Grundwassers. Dies lässt darauf schließen, dass Bodenluft und Grundwasser in dieser Studie scheinbar nicht im Lösungsgleichgewicht stehen. Eine transportlimitierende diffusive Grenzschicht in der Bodenluft direkt über dem Grundwasserspiegel scheint jedoch nur zum Teil die beobachteten Effekte erklären zu können.

UP 7: Beiträge der Deutschen Geophysikalischen Gesellschaft (DGG)

Zeit: Mittwoch 11:00–12:00 Raum: HS 5

Hauptvortrag UP 7.1 Mi 11:00 HS 5

Einsatz von geophysikalischen Verfahren zur Vorhersage von Bodenparametern für die Modellierung von Bodenfunktionen — •Peter Dietrich[1], Thorsten Behrens[2], Karsten Schmidt[2], Anne-Kathrin Nüsch[1], Claudia Dierke[1], Janine Krüger[1], Uwe Franko[1], Milan Kroulik[3], Lubos Burovka[3] und Ulrike Werban[1] — [1]Helmholtz-Zentrum für Umweltforschung GmbH - UFZ — [2]Universität Tübingen — [3]Czech University of Life Science Praque

Im FP7-Projekt iSOIL (Interactions between soil related sciences - Linking geophysics, soil science and digital soil mapping) wurden zuverlässige und schnelle Methoden zur Kartierung von Bodeneigenschaften entwickelt. Dazu wurden geophysikalische Messverfahren mit pedometrischen und bodenphysikalischen Untersuchungsansätzen kombiniert.

In einer Studie auf dem Standort Lany (Tschechien) mit einer Gesamtgröße von 21 ha wurde ein integrativer Ansatz getestet, bei dem schleppgeophysikalische Messungen (Elektromagnetische Induktion, Gammaspektrometrie) auf der Feldskala zunächst für die Vorhersage von Bodenparameter genutzt werden. Darauf basierend wurden in einem zweiten Schritt Bodenfunktionen wie die biologische Aktivitätsdauer und die Nährstoffauswaschung ins Grundwasser modelliert. Diese Parameter können zur Bewertung von potentiellen Gefährdungsbereichen und zukünftigen optimierten Managementempfehlungen herangezogen werden. Die Ergebnisse zeigen, dass der entwickelte Ansatz eine vielversprechende Erweiterung der bestehenden bodenkundlichen Methoden zur Prognose von Bodeneigenschaften auf der Feldskala ist.

Hauptvortrag UP 7.2 Mi 11:30 HS 5

Hochaufgelöste Verteilung elastischer Parameter im oberflächennahen Untergrund aus seismischen Wellenformen — •Florian Bleibinhaus — Universität Jena, Institut für Geowissenschaften

Die mechanischen Eigenschaften von Lockersedimenten führen bei oberflächennahen seismischen Messungen meist zu einem Verlust des hohen Frequenzanteils, den man zur Strukturabbildung mit reflektierten P-Wellen benötigt. Refraktionsseismische Verfahren bieten in solchen Fällen eine wichtige Alternative. Wenn man der refraktionsseismischen Inversion keine Laufzeiten, sondern das gesamte registrierte Kompressionswellenfeld zugrunde legt, kann man Auflösungen erreichen, die zumindest zum Abbilden von Aquiferen gut geeignet sind. Dies belegt eine Untersuchung der sedimentären Füllung des Salzachtals (Österreich). Die hochauflösenden seismischen Modelle der P-Wellengeschwindigkeit der bis zu 500 m mächtigen Talfüllung korrelieren sowohl mit vorhandenen Bohrprofilen als auch mit elektromagnetischen Untersuchungen, die analoge Strukturen in der Verteilung der elektrischen Leitfähigkeit zeigen.

UP 8: Ozeanographie

Zeit: Mittwoch 12:00–12:30 Raum: HS 5

Hauptvortrag UP 8.1 Mi 12:00 HS 5

The Changing Arctic Ocean: Observing Consequences of the 2012 Sea Ice Minimum in the Central Arctic — •Antje Boetius[1,2,3] and Shipboard Science Party of Expedition IceArc[4] — [1]Alfred Wegener Institute for Polar and Marine Research — [2]Max Planck Institute for Marine Microbiology — [3]MARUM University Bremen — [4]RV Polarstern ARK27-3 (02.08.-06.10.12)

In September 2012 the Arctic sea ice extent dropped to a new record minimum of 3.61 million square kilometers. In light of these drastic changes, questions arise as to the future of the Arctic ocean system, its productivity and biodiversity. Concurrent to the sea ice minimum, the expedition ARK-XXVII/3 *IceArc* (Sea ice - ocean - seafloor interactions in the changing Arctic) investigated the biology, chemistry and physics of sea ice and the impact of sea ice loss on the Central Arctic Basins. By integrated process studies, matter and energy fluxes were compared at locations with varying ice cover. Ice-, ocean- and seafloor moorings were deployed to observe sea ice thickness, circulation of Atlantic water and corresponding particle flux. We observed high biomasses of algae associated with sea-ice, and a massive export of sub-ice algal biomass to the deep-sea floor, as a result of the vast sea ice melt. The thinning ice supports a higher productivity of sub-ice diatoms by transmitting more light for a longer period. Furthermore, the increasing wind drift of ice floes may cause a better nutrient replenishment in the stratified surface layer. If the sea-ice retreat continues, substantial changes in the biogeochemistry and biodiversity of the ice-covered Arctic basins are to be expected.

UP 9: Mitgliederversammlung

Zeit: Mittwoch 12:30–14:00 Raum: HS 5

Mitgliederversammlung mit Mittagsimbiss

UP 10: Atmosphäre - Spurengase, Aerosole und Labormessungen

Zeit: Mittwoch 14:00–15:30 Raum: HS 5

UP 10.1 Mi 14:00 HS 5

First results from NIR lunar total column xCO_2 FTIR spectroscopy — •Matthias Buschmann, Nicholas Deutscher, Mathias Palm, Thorsten Warneke, Tine Weinzierl, and Justus Notholt — Institut für Umweltphysik, Universität Bremen, Bremen, Deutschland

The measurement of long-lived greenhouse gases, like CO_2 and CH_4, and identification of their sources and sinks is very important in the context of climate change research. Networks like the TCCON (Total Carbon Column Observing Network) continuously monitor a variety of trace gases in the atmosphere by employing ground based Fourier Transform InfraRed (FTIR) spectroscopy on solar radiation in the near infrared (NIR). A precision is yielded that is suitable for satellite and model validation and has given deeper insight in atmospheric chemical processes. However, at high latitude sites (like Ny Ålesund, Spitzbergen at 79° N), there is no direct sunlight in winter due to the polar night and the moon is the next best source of NIR radiation. In this talk we will present the first results of trace gas retrieval using a customised, cooled InGaAs detector at our site in Ny Ålesund.

UP 10.2 Mi 14:15 HS 5

A potential secondary ice process in tropospheric clouds — •Patricia Handmann, Thomas Pander, Alexei Kiselev, and Thomas Leisner — Karlsruher Institut für Technologie

Aerosols and water vapor are the two main constituents of clouds. At the same time, aerosols can nucleate ice in supercooled droplets and influence the precipitation processes in clouds via the WEGENER-BERGERON-FINDEISEN process of glaciation, when frozen droplets grow at the expense of liquid ones and fall to the ground. In experiments conducted at an electrodynamic trap with an attached high-speed camera, a potential secondary ice process influenced by aersols has been observed during the freezing of water droplets. Weak spots in the ice shell around a liquid core may crack up and bubbles may form which, once they break up, may eject small ice particles at several meters per second. This process may help in understanding the occasionally observed rapid glaciation in clouds.

UP 10.3 Mi 14:30 HS 5

Deliquescence and Efflorescence Behavior of Ternary Inorganic/Organic/Water Aerosol Particles — •Andreas Peckhaus[1], Stefan Grass[2], Lennart Treuel[2], and Reinhard Zellner[2] — [1]Karlsruher Institut für Technologie (KIT), Karlsruhe, Baden-Württemberg. — [2]Universität Duisburg-Essen, Essen, Nordrhein-Westfalen.

The deliquescence behavior of ternary inorganic /organic/water aerosol particles has been investigated at room temperature using a surface aerosol microscopy (SAM) technique. The results obtained for the deliquescence relative humidities (DRH) for deposited particles of variable inorganic/organic contents show a eutectic behavior with the mixed particles showing deliquescence at lower DRH compared to the pure inorganic and organic components, respectively. This behavior has been quantitatively modeled using the extended aerosol inorganics (E-AIM) thermodynamic model of Clegg et al. in combination with the UNIFAC group activity approach to account for organic molecular solutes. In addition, we have investigated the efflorescence behavior of supersatured and formerly deliquesced ternary solution droplets using space resolved Raman spectroscopy. In the efflorescing aerosol particles a partial crystallization of individual components is found. Further drying of such droplets produces solid particles in which the inorganic and organic phases show some spatial separation with the organic component being predominantly found at the outer part of the particle.

UP 10.4 Mi 14:45 HS 5

Heterogeneous Ice Nucleation of Micrometer Sized Water Droplets on Well Defined Surfaces — •Moritz Haarig, Isabelle Steinke, and Thomas Leisner — Karlsruher Institut für Technologie (KIT), Institut für Meteorologie und Klimaforschung - Atmosphärische Aerosolforschung (IMK-AAF))

Ice nucleation in clouds has an impact on global climate, because it influences the structure of clouds and thus precipitation and the global radiative budget. Often, aerosol particles are found to be immersed in water droplets where they initiate the formation of ice. However, it is still not clear which characteristics of the aerosol particles are important for being good ice nuclei.

In our experiment, we have created a testbed for immersion freezing where we can investigate the freezing of several hundreds of water droplets on well-characterized surfaces. We present freezing curves for silicon, copper and graphite and also the corresponding heterogeneous ice nucleation rates. We have also investigated the surface roughness of these materials with an atomic force microscope. Furthermore, in future studies we will change the surface properties of certain materials by chemical etching. This gives us the opportunity to learn more about the influence of different morphologies on the process of ice nucleation.

Kaffeepause, 30 min

UP 11: Umwelttechnologie und Hydrosphäre

Zeit: Mittwoch 15:30–16:30 Raum: HS 5

UP 11.1 Mi 15:30 HS 5

Thermobarer Effekt: Dichtegetriebene Strömungen in sehr tiefen Seen nahe der Temperatur der maximalen Dichte — •Bertram Boehrer — Helmholtz Zentrum für Umweltforschung UFZ, Magdeburg, Germany

Die (geringe) Kompressibilität von Wasser weist eine Temperaturabhängigkeit auf. Deshalb verschiebt sich die Temperatur der maximalen Dichte von 4°C unter Atmosphärendruck zu kleineren Werten bei höheren Drücken, also größeren Tiefen. Dieser thermobare Effekt hat Auswirkungen auf die Temperaturschichtung und die Tiefenzirkulation in sehr tiefen Seen. Für einen Spezialfall leiten wir dichtegetriebene Strömungen nahe der Temperatur der maximalen Dichte ab und untersuchen, inwieweit sich solche Effekte in sehr tiefen norwegischen Fjordseen nachweisen lassen.

UP 11.2 Mi 15:45 HS 5

Entwicklung eines Rußaerosolstandards zur Validierung von Partikelmessgeräten — •Margit Hildebrandt[1], Arne Kuntze[1], Anke Jordan-Gerkens[1], Andreas Nowak[1], Norbert Böse[1] und Volker Ebert[1,2] — [1]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig — [2]Center of Smart Interfaces, Technische Universiät Darmstadt, Petersenstr. 32, 64287 Darmstadt

Die Emission von Rußpartikeln aus Verbrennungsprozessen und insbesondere KFZ-Motoren hat gravierenden Einfluss auf die Luftqualität. Um trotz zunehmenden Verkehrs eine Verbesserung der Luftqualität zu erreichen, hat sich die Europäische Gemeinschaft in der Euro 6 Norm zu einer deutlichen Verringerung der zulässigen Grenzwerte von KFZ-Rußpartikel-Emissionen verpflichtet. Die Einhaltung dieser Grenzwerte lässt sich nur durch eine Weiterentwicklung der Motorentechnik in Hinblick auf geringere Rußemission umsetzen. Dies erfordert empfindlichere und stabilere Messgeräte sowie die Möglichkeit diese Messgeräte an einem Referenzaerosol zu validieren und zu kalibrieren. An der Physikalisch-Technischen Bundesanstalt, dem nationalen Metrologieinstitut, wird derzeit ein solcher Referenzmessaufbau entwickelt, der auf Basis eines neuartigen Rußgenerators die Erzeugung eines stabilen, reproduzierbaren und über einen großen Wertebereich einstellbaren Rußaerosols ermöglicht. Die Präsentation stellt den Rußaerosolgenerator, die angeschlossene Messtechnik und die Eigenschaften des erzeugten Aerosols vor. Zukünftig kann die Validierung von Messgeräten anhand des Referenzaerosols auf ultrafeine, atmosphärische Rußpartikel für umweltphysikalische Fragestellungen erweitert werden.

UP 11.3 Mi 16:00 HS 5

Bestimmung der Masse von Partikeln in Luft in ei-

nem Streulicht-Sensor, basierend auf der Divergenz des Laserstrahls und Trägheit-abhängiger Partikelbewegung — •Robert Schrobenhauser[1], Rainer Strzoda[2], Maximilian Fleischer[2] und Markus-Christian Amann[1] — [1]Technische Universität München, Walter Schottky Institut, Am Coulombwall 4, 85748 Garching — [2]Siemens AG, Corporate Technology, Otto-Hahn-Ring 6, 81739 München

In optischen Partikelsensoren kann die Partikelgröße aus der Intensität des Streulicht bestimmt werden, es steht jedoch keine Information über die Partikelmasse zur Verfügung. Wir stellen eine Methode und Messergebnisse vor, welche die Trägheit-abhängige Partikelbewegung verwendet, um die Dichte von Partikeln mit einem optischen System zu bestimmen. Die Grundlage des Effekts kann durch die Relaxationszeit beschrieben werden, die die Reaktionszeit des Partikels auf äußere Kräfte wieder gibt. Treten Partikel durch eine Düse in die optische Messkammer, so kreuzen sie auf Grund der seitlichen Ausbreitung des tragenden Aerosols statistisch verteilt den Laserstrahl an verschiedenen räumlichen Positionen. Leichte Partikel tendieren dabei dazu Änderungen des Aerosols in Richtung und Geschwindigkeit leichter zu folgen. Durch Unterschiede in den resultierenden räumlichen Verteilungen im Vergleich zu einer zuvor bekannten Referenzmessung, kann auf die zu Grunde liegende Dichte der gemessenen Partikel geschlossen werden. Die räumliche Verteilung wird dabei aus der Durchtrittszeit der Partikel durch den divergenten Laserstrahl gewonnen.

UP 11.4 Mi 16:15 HS 5

Die Änderung der Himmelsfarbe durch Climate Engineering Maßnahmen — •Eva Ahbe, Ulrich Platt, Thomas Leisner und Tim Deutschmann — Institut für Umweltphysik, Ruprecht-Karls-Universität Heidelberg, Deutschland

Im Rahmen des Climate Engineering werden Maßnahmen vorgeschlagen um die Folgen des anthropogenen Klimawandels zu reduzieren. Eine Implementierung solcher Maßnahmen hätte jedoch unerwünschte Nebeneffekte zur Folge, die sich nicht nur auf die Umwelt auswirken sondern auch politische, kulturelle und moralische Fragestellungen aufwerfen.

Eine Methode, die die direkte Sonneneinstrahlung auf die Erdoberfläche vermindert und damit eine Abkühlung der globalen Temperatur herbeiführt, besteht in der Injektion von reflektierenden Aerosolen in die Stratosphäre. Der Anteil an diffusem Licht würde sich damit erhöhen und zu einem veränderten Strahlungshaushalt in der Atmosphäre führen. Dies würde unter anderem eine Änderung der Himmelsfarbe bewirken.

Der Strahlungstransport in der Atmosphäre wurde für verschiedene Aerosolszenarien simuliert und daraus der Farbeindruck gewonnen, wobei im Besonderen auf den Fall einer Sulfatinjektion zur Kompensation einer CO_2-Verdopplung eingegangen wurde. Im Rahmen dieses Vortrags sollen die für verschiedene Szenarien berechneten Farbänderungen des Himmels vorgestellt werden.

UP 12: Postersession

Zeit: Mittwoch 16:45–18:15 Raum: Poster EG

Fortführung der Postersession

UP 13: Methoden - Fernerkundung, Messverfahren und Datenauswertung

Zeit: Donnerstag 9:00–10:00 Raum: HS 5

Hauptvortrag UP 13.1 Do 9:00 HS 5

From SCIAMACHY to the next generation of remote sensing instrumentation. — •John Burrows — Institut für Umweltphysik der Universität Bremen, Postfach 330440, 28334 Bremen

In the past three decades, the remote sensing of atmospheric trace constituents has passed through a pioneering age. SCIAMACHY (SCanning Imaging Absorption spectrometer for Atmospheric CHartography), which flew on ENVISAT from 2002 to 2012 when contact was lost with ENVISAT, and its spin off GOME, which flew on ERS-2 until it was was decommissioned by ESA , are now being succeeded by a new generation such as GOME-2 on the Metop series. However much has been lost with the end of Envisat. There is an urgent need for new instrumentation. This talk will address some of the past successes and point out the needs and opportunities for the coming years. This will include the potential use of the International space station.

UP 13.2 Do 9:30 HS 5

2.7μm open-path TDL-spectrometer for simultaneous in situ $H_2\,^{18}O/H_2\,^{16}O$ measurements in clouds — •Benjamin Kühnreich[1,2], Jan Habig[3], Steven Wagner[2], Harald Saathoff[3], Liz Moyer[4], and Volker Ebert[1,2] — [1]Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig — [2]Center of Smart Interfaces, Technische Universität Darmstadt, Petersenstr. 32, 64287 Darmstadt — [3]Karlsruhe Institute of Technology, Herrmann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen — [4]Department of Geophysical Sciences, University of Chicago

Isotopic tracers are widely used to investigate environmental processes. Recently there has been interest in using changes in the isotopic composition of water vapour to investigate microphysical cloud formation processes. We report here on the development of a new instrumentation for the measurement of isotopic composition changes in clouds in the DFG/NSF funded ISOCLOUD project. In situ open-path TDLAS provides a non-invasive, sampling free measurement technique appropriate for this purpose. We describe one of the ISOCLOUD instruments, an open-path TDL around 2.7μm, and show preliminary data from its first application in the cloud simulation chamber AIDA for the measurement of the isotopic ratio of $H_2\,^{18}O/H_2\,^{16}O$. We discuss current and future in situ detection limits. Current data based on 280 m absorption path indicate detection limits of 0.2 ppb for $H_2\,^{18}O$ and 80.6 ppb for $H_2\,^{16}O$.

UP 13.3 Do 9:45 HS 5

Microwave Remote Sensing of Sea Ice Thickness - Retrieval and Validation — •Marcus Huntemann and Georg Heygster — Institut für Umweltphysik, Universiät Bremen

Sea ice has been requested by WMO (World Meteorological Organization) as one of the essential variables for climate and weather modeling and prediction. The sea ice concentration has been observed since over three decades by satellite based microwave radiometers, while obtaining the sea ice thickness is more complicated. The SMOS (Soil Moisture and Ocean Salinity) satellite, operating since January 2010, works at 1.4 GHz (L-band), the lowest microwave frequency currently used in satellite remote sensing. SMOS employs a aperture synthesis technique and observes a single location at different incident angles during one overflight with a spatial resolution of about 50 km. By comparison of thermodynamic ice growth data with SMOS brightness temperatures in the Kara Sea we found a high correlation of sea ice thickness with the intensity and an anti correlation of sea ice thickness with the difference of horizontally and vertically polarized brightness temperatures. From that we developed an empirical retrieval algorithm for the sea ice thickness of up to 50 cm during the freeze-up period. In the validation against in-situ measurements, satellite data and regional models our SMOS sea ice thickness retrieval achieves high correlations in several different regions.

UP 14: Atmosphäre - Spurengase, Aerosole und Labormessungen

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

UP 14.1 Do 10:00 HS 5

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

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

UP 14.2 Do 10:15 HS 5

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

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

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

Kaffeepause, 30 min

Hauptvortrag UP 14.3 Do 11:00 HS 5

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

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

UP 14.4 Do 11:30 HS 5

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

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

UP 14.5 Do 11:45 HS 5

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

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

UP 14.6 Do 12:00 HS 5

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

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

UP 14.7 Do 12:15 HS 5

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

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

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

UP 15: Symposium Einfluss der Sonne auf das Klima der Erde

Zeit: Donnerstag 14:00–16:00 Raum: HS 2

Hauptvortrag UP 15.1 Do 14:00 HS 2

Solar irradiance variability — •Sami Solanki — Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany

The Sun ist now known to be a variable Star.

Since 1978 satellite based radiometers have been measuring changes in solar irradiance, so that the available record now covers 3 solar cycles. These data have uncoverd a rich structure of the variable solar irradiance. In addition, the physical understanding of irradiance variations and the detailed reconstruction of this quantity (both for the time in which observations are available and for earlier times) have made great strides over the last years. However, there are some significant differences between observations and models regarding the spectral irradiance, which is of great promise for affecting the Earth's atmosphere and also climate.

In this talk an overview of the measurements and the modelling of total and spectral irradiance variations is given, highlighting in particular the progress of the last few years, but also pointing out the problems.

Hauptvortrag UP 15.2 Do 14:30 HS 2

Influence of Galactic Cosmic Rays and solar variability on aerosols, clouds and climate: Results from the CLOUD experiment at CERN — •Joachim Curtius — Institute for Atmosph. & Envir. Sciences, Univ. of Frankfurt/Main, Germany

The potential influence of ions produced from galactic cosmic rays on the formation of new aerosol particles in the atmosphere may play an important role relevant for aerosol properties, cloud formation and climate. Variability of galactic cosmic rays due to modulating influences from the sun therefore may affect (regional) climate on various time scales. A quantitative understanding of the role of ions for atmospheric aerosol formation has not been reached, but also the dependence of aerosol formation on the concentration of the nucleating substances such as gaseous sulfuric acid, ammonia and amines is missing.

Here results from the CLOUD experiment at CERN are presented. CLOUD is a new aerosol and cloud chamber facility at CERN. The chamber can be exposed to a pion beam from CERN to simulate various levels of atmospheric ionization. CLOUD has been set up to investigate aerosol and cloud processes under well-controlled laboratory conditions. We find that cosmic ray ionization substantially increases the nucleation rate of pure sulfuric acid/water particles while charge effects are much less pronounced for ternary systems including ammonia or dimethylamine. The results from the CLOUD experiments have been used to develop a new parameterization of aerosol nucleation which has been included in a global climate model. Impacts of our findings for cloud formation and climate are discussed.

Hauptvortrag UP 15.3 Do 15:00 HS 2

NO_x - the energetic particle - climate connection? — •Thomas Reddmann — KIT Karlsruhe

In addition to the variability of the solar spectrum in the UV and VIS part, and the modulation of cosmic galactic radiation with the solar cycle, the solar wind impresses the signs of solar activity to the upper parts of the Earth's atmosphere. Energetic particles as protons in the MeV range from eruptive processes on the Sun's surface, or electrons accelerated within the magnetosphere of the Earth, sometimes to relativistic energies, ultimately reach the lower thermosphere and mesophere. This particle precipitation causes local ionization and subsequently reactive gases as NO_x and HO_x are produced. Observations from satellites during the last decade, for example from the atmospheric instruments MIPAS and SCIAMACHY on the European ENVISAT satellite, have shown that following solar eruptive events or geomagnetic storms the concentration of the reactive gases can reach considerable amounts. During polar winter when NO_x is long-lived, downward transport of NO_x can bring it even to the stratosphere and to the ozone layer where it causes additional ozone loss. For the middle atmosphere, where ozone essentially determines the radiative heating rate, the dynamical state of the middle atmosphere is therefore somehow coupled to the precipitation of the particles, and via stratosphere-troposphere coupling this may even propagate to the surface and impact climate. On the other hand, the strength of the downward transport itself strongly depends on the dynamical state of the middle atmosphere. This chemical dynamical coupling and the role of energetic particles is a topic of current research. Recent results of observations and model simulations will be presented and open questions of this mechanism will be discussed.

Hauptvortrag UP 15.4 Do 15:30 HS 2

Impact of the solar 11-year and 27-day cycles on the Earth's middle atmosphere — •Christian von Savigny — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Germany

Separating potential anthropogenic effects from natural variability - induced by solar variability in particular - is an important issue in atmospheric science. This is especially true for the middle atmosphere where both anthropogenic and solar effects are generally significantly larger than near the surface. This contribution will provide an overview of the current understanding of the impact of solar variability at the 11-year and 27-day time scales on the middle atmosphere with a special focus on temperature effects. The existence of an 11-year solar cycle signature in middle atmospheric temperature is well established, but estimates of the quantitative temperature sensitivity to changes in solar forcing differ considerably. The majority of the studies yield sensitivities of mesospheric temperature to solar forcing of about 1 - 4 K / (100 sfu). Recent studies suggest that the sensitivity values for the 11-year and the 27-day cycles are very similar, implying that the same underlying physical/chemical processes drive atmospheric temperature variability at these very different time scales. These studies also provide evidence that solar variability affects the middle atmosphere essentially instantaneously showing time lags of 1-2 days at most. The individual contributions of the chemical and physical processes driving the atmosphere's temperature response to changes in solar forcing are, however, not well known.