Environmental Physics Division
Fachverband Umweltphysik (UP)

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Overview of Invited Talks and Sessions

(lecture rooms HFT-FT 131; Poster F)

Plenary and Keynote Talks related to UP

PV V	Mon	17:00–17:45	A 151	**Max-von-Laue-Lecture: The Scientific Consensus on Climate Change: Where Do We Go From Here?** — •Naomi Oreskes
PV XVI	Wed	14:00–14:45	HE 101	**The global carbon cycle in the climate system: To which extent is it manageable?** — •Martin Heimann
PV XVIII	Thu	8:30– 9:15	H 0105	**The Complex Physics of Climate Change: Nonlinearity and Stochasticity** — •Michael Ghil

Invited Talks

UP 2.1	Tue	9:30–10:00	HFT-FT 131	**Formation of secondary organic aerosol from biogenic emissions** — •Astrid Kiendler-Scharr, Jürgen Wildt, Thomas Mentel, Einhard Kleist, Ralf Tillmann
UP 7.1	Wed	15:00–15:30	HFT-FT 131	**Uncertainties of sea ice thickness estimates from SMOS radiometry and CryoSat-2 synthetic aperture radar altimetry** — •Lars Kaleschke, Nina Maass, Xiangshan Tian-Kunze
UP 7.3	Wed	15:45–16:15	HFT-FT 131	**Oceanographic measurements in Fram Strait – a gateway to the Arctic Ocean** — •Florian Greil, Agnieszka Beszczynska-Möller, Ursula Schauer
UP 8.1	Wed	17:15–17:45	HFT-FT 131	**From fs-LIDAR Sensing of the Atmosphere to fs-Optical Control** — •Ludger Woeste, Kamil Stelmaszczyk, Roland Sauerbrey, Jerome Kasparian, Jean PierreKamil Wolf
UP 12.1	Thu	10:00–10:30	HFT-FT 131	**The first Arctic ozone hole in spring 2011 - observations, current understanding and relation to climate change** — •Markus Rex, Ingo Wohltmann, Peter von der Gathen, Ralph Lehmann
UP 12.2	Thu	11:00–11:30	HFT-FT 131	**Potential tipping elements of the climate system** — •Anders Levermann
UP 12.5	Thu	12:00–12:30	HFT-FT 131	**How variable is our climate?** — •Thomas Laepple, Peter Huybers
UP 14.6	Thu	15:45–16:15	HFT-FT 131	**Detection of gaseous sulphur and halogen species in the outgassing plume from volcano Mt. Etna** — •Christiane Voigt, Philipp Jessberger, Domink Schäuble, Tina Jurkat, Robert Baumann, Guiseppe Salerno, Nicole Brobowski

Invited talks of the joint symposium SYCF

See SYCF for the full program of the symposium.

SYCF 1.1	Wed	9:30–10:00	H 0105	**Der Reaktorunfall von Fukushima: Unfallablauf, Emissionen, Immissionen** — •Gerald Kirchner, Bernhard Fischer
SYCF 1.2	Wed	10:00–10:30	H 0105	**Radiologische und radioökologische Aspekte des Reaktorunfalles von Fukushima** — •Gerhard Proehl

SYCF 1.3	Wed	10:30–11:00	H 0105	**Wie Fukushima die Energiepolitik und Energieforschung in Deutschland und international verändert** — •Joachim Knebel
SYCF 1.4	Wed	11:00–11:30	H 0105	**Entscheidungszwänge in der Weltenergieversorgung und Klimapolitik bei hoher Unsicherheit** — •Carl Christian von Weizsäcker

Sessions

UP 1.1–1.1	Mon	17:00–17:45	A 151	**Lecture by Naomi Oreskes on Climate Change**
UP 2.1–2.7	Tue	9:30–12:00	HFT-FT 131	**Atmosphere 1**
UP 3.1–3.3	Tue	12:00–12:45	HFT-FT 131	**Radioactivity and Soil**
UP 4.1–4.4	Wed	9:30–12:00	H 0105	**Symposium "Fukushima und die Konsequenzen"**
UP 5	Wed	12:30–13:30	HFT-FT 131	**Fachverbandstreffen**
UP 6.1–6.1	Wed	14:00–14:45	HE 101	**Lecture by Martin Heimann on carbon cycle**
UP 7.1–7.5	Wed	15:00–17:15	HFT-FT 131	**Cryosphere, Hydrosphere and Oceanography**
UP 8.1–8.4	Wed	17:15–18:30	HFT-FT 131	**Methods 1**
UP 9.1–9.31	Wed	18:30–19:15	Poster F	**Poster session**
UP 10.1–10.1	Thu	8:30– 9:15	H 0105	**Lecture by Michael Ghil on Climate Change**
UP 11.1–11.2	Thu	9:30–10:00	HFT-FT 131	**Methods 2**
UP 12.1–12.5	Thu	10:00–12:30	HFT-FT 131	**Climate - Modelling, joint session with jDPG**
UP 13	Thu	12:30–13:30	Poster F	**Poster session (continued from Thuesday evening)**
UP 14.1–14.10	Thu	14:00–17:15	HFT-FT 131	**Atmosphere 2**

Annual Meeting of the Environmental Physics Division (Mitgliederversammlung mit Imbiss)

Mittwoch 12:30–13:30 HFT-131

Vorläufige Tagesordnungspunkte:
- Bericht des Sprechers
- Aktivitäten des Fachverbandes
- Geplante Sommerschulen und Seminare
- Verschiedenes

UP 1: Lecture by Naomi Oreskes on Climate Change

Time: Monday 17:00–17:45 Location: A 151

Evening Talk UP 1.1 Mon 17:00 A 151

Max-von-Laue-Lecture: The Scientific Consensus on Climate Change: Where Do We Go From Here? — •Naomi Oreskes — University of California, San Diego

In 2004, I published an article documenting the widespread agreement among scientific researchers that anthropogenic climate change was underway. This agreement was made evident by statements of leading scientific societies and national and Royal Academies, and by the content of papers published in peer-reviewed journals. Yet, despite broad expert agreement, action on slowing, much less preventing further, climate change has been sluggish. Does this mean that our science has failed us? In this talk I discuss the implications of our collective inaction on anthropogenic climate change in the light of our current scientific knowledge.

UP 2: Atmosphere 1

Time: Tuesday 9:30–12:00 Location: HFT-FT 131

Invited Talk UP 2.1 Tue 9:30 HFT-FT 131

Formation of secondary organic aerosol from biogenic emissions — •Astrid Kiendler-Scharr, Jürgen Wildt, Thomas Mentel, Einhard Kleist, and Ralf Tillmann — Forschungszentrum Jülich GmbH, Jülich, Deutschland

Atmospheric oxidation of VOCs contributes to new particle formation and atmospheric organic aerosol mass [1]. The formation of aerosols from biogenic VOC emissions constitutes a possible feedback element in biosphere-atmosphere-climate interactions due to the overall cooling effect of aerosols [2]. This assumes increasing VOC emission strengths with increasing temperature and emission patterns being invariant to temperature changes. Recently evidence emerges that temperature induced changes in VOC emission patterns may alter the picture. It has been shown that increased isoprene emissions may suppress atmospheric new particle formation [3] thus dampening the cooling effect of aerosols formed from biogenic VOCs.

In addition the use of direct emissions of VOCs from plants in experiments studying secondary organic aerosol (SOA) formation shows that, beyond the so far considered main compound classes isoprene and its derivatives monoterpenes and sesquiterpenes, other VOC classes significantly impact SOA formation. Many of these VOCs are emitted under plant stress conditions.

An overview of the state of the art knowledge of SOA formation from biogenic VOCs with respect to different VOC classes will be given.

[1] Hallquist et al. ACP (2010)[2] Kulmala et al. ACP (2004)[3] Kiendler-Scharr et al. Nature (2009)

UP 2.2 Tue 10:00 HFT-FT 131

Conditions for the fragmentation of supercooled cloud droplets — •Thomas Pander, Kai-Uwe Nerding, and Thomas Leisner — Karlsruhe Institute of Technology, Germany

The rapid glacification of tropospheric clouds is a remaining mystery in cloud physics. Commonly, this process is attributed to secondary ice processes or 'ice multiplication'. One of the proposed mechanisms, the fragmentation of freezing water droplets was investigated using supercooled droplets observed in an electrodynamical levitator. After freezing initiation by collision with an small ice particle, the supercooled droplets freeze in an two stage process. During the first rapid phase, the droplet is heated by the latent heat of freezing to the melting point within several hundred microseconds. After that, the ice growth rate is limited by the diffusive heat removal from the droplet and the remaining water freezes from outside in within several hundred milliseconds. During that phase, pressure inside the droplet can build up due to the density change associated with the phase change and due to dissolved gases that are excluded from the crystalline ice. Eventually, the outer ice shell may rupture under this pressure and the droplet may fragment or small ice particles may be released. We report the dependence of the probability of such disintegration processes as a function of temperature and the content of solid particles within the droplet.

UP 2.3 Tue 10:15 HFT-FT 131

Ice nucleation and growth on atmospheric aerosol particles studied in the Environmental Scanning Electron Microscope — •Alexei Kiselev[1], Volker Zibat[2], and Thomas Leisner[1] — [1]Karlsruher Institut für Technologie (KIT) Institut für Meteorologie und Klimaforschung (IMK-AAF) — [2]Karlsruher Institut für Technologie (KIT) Laboratorium für Elektronenmikroskopie (LEM)

Environmental scanning electron microscopy (ESEM) enables in situ observation of interactions between water vapor and aerosol particles in the sub-micrometer range. By increasing the H2O pressure in the sample chamber at constant temperature, ice formation can be observed directly and can be related to the morphology and chemical composition of the particles. At the same time, the aerosol particles proved to have the highest ice nucleating ability can be studied simultaneously by energy-dispersive X-ray microanalysis (EDX). In this contribution we describe the experimental setup, calibration procedure and show the first results of the ice nucleation on mineral dust particles and bacteria studied in ESEM.

UP 2.4 Tue 10:30 HFT-FT 131

Kontaktgefrieren unterkühlter Wolkentropfen an Mineralstaubpartikeln — •Nadine Hoffmann, Thomas Leisner und Daniel Rzesanke — Karlsruher Institut für Technologie

Das Kontaktgefrieren ist ein wichtiger heterogener Mechanismus der Eisbildung in der unteren Troposphäre. [1] Bei dieser Art des Gefrierens geht ein unterkühlter Wolkentropfen beim Kontakt mit einem Eiskeim in seinen festen Aggregatzustand über. Wir berichten in diesem Beitrag über Laborexperimente zum Kontaktgefrier- Wahrscheinlichkeit größenselektierter Mineralstaubpartikel als Funktion der Temperatur, des Mineraltyps und der Partikelgröße. Unterkühlte Wassertröpfchen werden dabei in einem elektrodynamischen Levitator unter realistischen atmosphärischen Bedingungen einem wohl charakterisierten Aerosolstrom ausgesetzt; ihr Gefrieren wird optisch nachgewiesen. Die genaue Kontrolle aller Versuchsparameter erlaubt die Bestimmung der Wahrscheinlichkeit des Gefrierens bei einem einzelnen Kollissionsereignis. [1] K.C. Young, The role of contact nucleation in ice phase initiation in clouds, Journal of the atmospheric sciences 31, 1974

30 min coffee break

UP 2.5 Tue 11:15 HFT-FT 131

Retrospektive Bestimmung der Aktivitätsgrößenverteilung und der Löslichkeit in der Lunge für eine individuelle Inhalationsdosimetrie — •Oliver Meisenberg[1], Evgeni Garger[2] und Jochen Tschiersch[1] — [1]Helmholtz Zentrum München, Institut für Strahlenschutz, Neuherberg — [2]Institute of Radioecology, Kiew

Wichtige Parameter für die Berechnung der Inhalationsdosis durch radioaktives Aerosol sind die Größenverteilung der Aktivität und die Löslichkeit der Radionuklide in der Lunge. Die Bestimmung der Aktivitätsgrößenverteilung in situ ist aufgrund der benötigten Ausstattung oft nicht möglich. Deshalb wurde ein Verfahren entwickelt, die Größenverteilung aus Filterproben retrospektiv im Labor zu bestimmen: Das gesammelte Aerosol wird von den Filtern in ein Lösemittel extrahiert und anschließend in einem Aerosolgenerator wieder in die Luft überführt. Die Größenklassifizierung erfolgt in einem Kaskadenimpaktor.

Außerdem wurde die Löslichkeit einiger bedeutender Radionuklide aus heißen Kernbrennstoffteilchen in simulierte Lungenflüssigkeit bestimmt. Dazu wurden Filterfragmente mit heißen Teilchen in die Lungenflüssigkeit getaucht. Zu verschiedenen Zeiten innerhalb einiger Tage wurden Proben der Flüssigkeit genommen, um die Aktivität von ^{90}Sr, ^{137}Cs, $^{239+240}$Pu und ^{241}Am darin zu bestimmen. Die Größe der heißen Teilchen sowie ihre Genese wurden als wichtige Parameter identifiziert.

Beide Verfahren wurden auf Filterproben aus Tschernobyl angewendet, um die Berechnung individueller Dosiskoeffizienten für die dorti-

gen Arbeiter zu ermöglichen.

UP 2.6 Tue 11:30 HFT-FT 131

Eisnukleationseigenschaften von Mineralstaubpartikeln mit biologischen Komponenten und Beschichtungen — •Isabelle Steinke[1], Corinna Hoose[1], Ottmar Möhler[1], Alexei Kiselev[1], Monika Niemand[1], Harald Saathoff[1], Martin Schnaiter[1], Julian Skrotzki[1] und Thomas Leisner[1,2] — [1]Karlsruhe Institute of Technology (KIT), Institut für Meteorologie und Klimaforschung - Atmosphärische Aerosolforschung (IMK-AAF), Karlsruhe — [2]Institut für Umweltphysik, Ruprecht-Karls-Universität Heidelberg, Heidelberg

Aerosole und Wolken können über eine Vielzahl von Prozessen miteinander wechselwirken: die heterogene Eisbildung in Wolken hat dabei einen signifikanten Einfluss sowohl auf die Strahlungsbilanz der Erde als auch auf den globalen Wasserkreislauf. In der Wolkenkammer AIDA (Aerosol Interaction and Dynamics in the Atmosphere) kann die Eisbildung für verschiedene, besonders häufige Aerosoltypen wie z.B. Mineralstäube untersucht werden. Es werden Resultate aus verschiedenen Messkampagnen vorgestellt, bei denen die Eisnukleationseffizienzen von einigen Mineralstaubtypen untersucht wurden. Hierbei wird auch auf eine mögliche Verstärkung der Eisbildung durch biologische Komponenten und den Einfluss von organischen und inorganischen Beschichtungen eingegangen. Ergänzt wird die Präsentation der experimentellen Ergebnisse durch numerische Rechnungen mit dem Boxmodell ACPIM.

UP 2.7 Tue 11:45 HFT-FT 131

Tropospheric ozone column retrieval from SCIAMACHY limb-nadir-matching observations — •Felix Ebojie, Christian Savigny, Annette Ladstätter-Weissenmayer, Mark Weber, Stefan Bötel, Rozanov Alexei, Heinrich Bovensmann, and John Burrows — Institute of Environmental Physics (IUP), University of Bremen, P.O. Box 330440, D-28334 Bremen, Germany

Tropospheric ozone is a pollutant, a constituent of smog and its strong oxidizing ability leads to the formation of many toxic oxides. Ozone also acts as a greenhouse gas, with highest efficiency in the upper troposphere and lower stratosphere. This study presents the retrieval of tropospheric column ozone (TCO) from the limb-nadir matching observations of the Scanning Imaging Absorption spectroMeter for Atmospheric CHartographY (SCIAMACHY) onboard Envisat. This retrieval technique involves the subtraction of the stratospheric column ozone (SCO) derived from the limb observations from the total ozone columns (TOC) derived from the nadir observations. Equally of importance in our analysis is the TCO derived from the ozonesondes by integrating the tropospheric ozone profiles from the bottom to the top of the troposphere, which was determined from the sonde temperature profile measurements using the WMO lapse rate criterion definition of the thermal tropopause. Our retrievals are compared with retrievals from ozonesondes and other satellites instruments, with results showing good agreements with some slight deviations of about 5-10 DU. Finally, some possible sources of error in our analysis are discussed.

UP 3: Radioactivity and Soil

Time: Tuesday 12:00–12:45 Location: HFT-FT 131

UP 3.1 Tue 12:00 HFT-FT 131

Vom Regenwasser zur Milch - Radionuklide aus Fukushima in Norddeutschland — •Helmut W. Fischer, Daniela Pittauerová und Bernd Hettwig — Universität Bremen, Institut für Umweltphysik

Die Emissionen aus den havarierten Kernreaktoren am Standort Fukushima Dai-ichi konnten im Laufe einiger Wochen weltweit in der Atmosphäre nachgewiesen werden. In Europa waren die Konzentrationen allerdings mit maximal einigen mBq/m^3 sehr gering. Terrestrische Messdaten wurden kaum publiziert.

Proben von Regenwasser, Sediment aus Oberflächengewässern, Boden, Gras und Kuhmilch wurden per hochauflösender Gammaspektroskopie untersucht und zeigten geringe, aber eindeutig nachweisbare Konzentrationswerte des kurzlebigen I-131 (T1/2 = 8 d). Cs-137 (T1/2 = 30,1 a) konnte in allen Proben mit Ausnahme von Regenwasser und Milch nachgewiesen werden. Nur in den Grasproben wurde Cs-134 (T1/2 = 2,06 a) gefunden. Hierdurch konnte frischer Eintrag aus Fukushima von Ablagerungen aus Tschernobyl und dem Atomwaffentest-Fallout unterschieden werden, da in letzteren nur noch Cs-137 in nennenswerten Anteilen vorhanden ist.

Ein Vergleich der Konzentration von I-131 in Regenwasser, Sediment, Gras und Milch mit einfachen Modellrechnungen zur Prognose des Umweltverhaltens von Radioisotopen ergab eine recht gute Übereinstimmung. Es ist somit plausibel, dass die (mit 0,08 Bq/l sehr geringe) I-131-Konzentration in Kuhmilch tatsächlich aus den Freisetzungen von Fukushima stammte.

UP 3.2 Tue 12:15 HFT-FT 131

Thoron in bayerischen Fachwerkhäusern — •Stefanie Gierl[1], Jochen Tschiersch[1], Lei Bi[1,2] und Oliver Meisenberg[1] — [1]Helmholtz Zentrum München, Institut für Strahlenschutz, 85764 Neuherberg, Deutschland — [2]Department of Engineering Physics, Tsinghua University, Beijing 100084, China

Zur Radonexposition in Deutschland wurden schon vielfältige Untersuchungen durchgeführt. Das Radonisotop Thoron wurde bisher aufgrund seiner kurzen Halbwertszeit von 55,6 Sekunden bei Messungen oft ignoriert. Nachdem herausgefunden wurde, dass ungebrannter Lehm eine hohe Thoronexhalationsrate besitzt, werden nun Messungen in Fachwerk- und anderen Lehmhäusern durchgeführt.

Da die langlebigen Thoronfolgeprodukte den hauptsächlichen Beitrag zur Dosis leisten, müssen eben diese gemessen werden. Messungen an einer beliebigen Stelle im Raum sind dann möglich, da sich die Folgeprodukte homogen verteilen. Ein speziell entwickeltes passives Messgerät erzeugt durch Hochspannung ein elektrisches Feld und sammelt an geladene Aerosolpartikel angelagerte Folgeprodukte auf Kernspurdetektoren. Damit lassen sich die Folgeproduktkonzentrationen von Radon und Thoron bestimmen.

Erste Messungen in einem Fachwerkhaus konnten die Vermutung nach einer erhöhten Thoron-Folgeproduktkonzentration bestätigen. Aus dem Mittelwert der Potentiellen Alphaenergiekonzentration einer zweiwöchigen Messung ergibt sich bei einer Aufenthaltsdauer von 10 Stunden pro Tag für die Bewohner eine zusätzliche effektive Dosis von 1,6 mSv pro Jahr durch Thoronfolgeprodukte.

UP 3.3 Tue 12:30 HFT-FT 131

Binding of Chlorinated Organic Pollutants to Soils — •Ashour Ahmed[1,2], Sergei D. Ivanov[1], Oliver Kühn[1], and Peter Leinweber[2] — [1]Institute of Physics, University of Rostock, Rostock, Germany — [2]Institute of Land-Use, University of Rostock, Rostock, Germany

Pollutants can be adsorbed to soil constituents, taken up by plant roots and/or leached through the unsaturated zone eventually reaching the groundwater. Exposure to these pollutants can cause disruption of endocrine, reproductive, and immune systems; neurobehavioral disorders; cancers and finally death. Thus, understanding binding mechanisms in pollutant-soil complexes is of topmost importance. We studied the adsorption of Hexachlorobenzene (HCB), which is one of the most widespread pollutants in the soil, to different soil samples. These samples were characterized and classified by elemental analysis, mass spectrometry, and X-ray measurements. These investigations revealed a strong dependence of the adsorption strength on the composition of soil organic matter (SOM). In an attempt to simulate abundant SOM, we modeled it by a representative set of molecular systems containing the most interesting functional groups. SOM-HCB complexes were studied by ab initio calculations in the gas phase. The respective binding energies are in accord with the experimental results. In order to calculate the corresponding binding free energies and to study the mechanism of the binding in solution we are employing empirical force field and ab initio molecular dynamics techniques.

UP 4: Symposium "Fukushima und die Konsequenzen"

Time: Wednesday 9:30–12:00 Location: H 0105

Invited Talk UP 4.1 Wed 9:30 H 0105

Der Reaktorunfall von Fukushima: Unfallablauf, Emissionen, Immissionen — •Gerald Kirchner und Bernhard Fischer — Bundesamt für Strahlenschutz,38226 Salzgitter

Der Unfall in Fukushima hat massive Emissionen radioaktiver Stoffe in die Biosphäre verursacht. In dem Vortrag werden zunächst die wesentlichen Unfallabläufe in den vier betroffenen Reaktorblöcken dargestellt sowie die Prozesse erläutert, die zu den Freisetzungen der Radionuklide geführt haben. Das aufgrund dieser Mechanismen resultierende Nuklidspektrum wird diskutiert. Mit Schwerpunkt auf den atmosphärischen Freisetzungen werden die relevanten Transportprozesse vorgestellt und anhand der unter anderem im Bundesamt für Strahlenschutz eingesetzten Prognosemodelle illustriert. Anhand lokaler, regionaler und globaler Messungen werden die als Konsequenz des Unfallgeschehens zu erwartenden Strahlenexpositionen klassifiziert.

Invited Talk UP 4.2 Wed 10:00 H 0105

Radiologische und radioökologische Aspekte des Reaktorunfalles von Fukushima — •Gerhard Proehl — International Atomic Energy Agency

Die Freisetzung von radioaktiven Stoffen während des Reaktorunfalls von Fukushima führte zu einer Kontamination von Luft, Böden, Wasser und Nahrungsmitteln. Die Bevölkerung in einem Umkreis von 20 km wurde sofort evakuiert, in weiteren Gebieten außerhalb der 20 km-Zone, nordwestlich des Kraftwerks wurde Ende April 2011 die Evakuierung empfohlen.

Der Vortrag behandelt radiologische und radioökologische Aspekte des Reaktorunfalls von Fukushima. Schwerpunkte liegen auf der Freisetzung von Radionukliden, einer Erörterung der Messungen von Dosisraten und Aktivitäten in Umweltmedien sowie einer Analyse der relevanten Expositionspfade. Getroffene Gegenmaßnahmen und Anstrengungen, die Rückkehr der Bevölkerung in die evakuierten Gebiete zu ermöglichen, werden diskutiert. Ein Vergleich mit radioökologischen Aspekten des Reaktorunfalls von Tschernobyl schließt den Vortrag ab.

Invited Talk UP 4.3 Wed 10:30 H 0105

Wie Fukushima die Energiepolitik und Energieforschung in Deutschland und international verändert — •Joachim Knebel — Karlsruher Institut für Technologie (KIT)

Die Reaktorkatastrophe von Fukushima hat die Landschaften von Energieforschung und Stromerzeugung in Deutschland dauerhaft verändert. Mit dem beschlossenen beschleunigten Abschalten der deutschen Kernkraftwerke bis 2022, dem Ausbau der erneuerbaren Energien, der Erhöhung der Energieeffizienz, der Entwicklung von Speichertechnologien sowie dem Ausbau der Netze will Deutschland die Energiewende zügig umsetzen und international eine Vorreiterrolle einnehmen. Wichtig sind in diesem Zusammenhang auch der Aspekt der (Elektro-) Mobilität und Fragen der sozialen Akzeptanz zukünftiger Energietechnologien.

Auf internationalem Parkett sind die Reaktionen und Entscheidungen der Regierungen jedoch deutlich verhaltener. Die Situation in Deutschland wird mit der Situation in ausgewählten Ländern (u.a. USA, Frankreich, Polen, Tschechien, China, Japan) verglichen.

Invited Talk UP 4.4 Wed 11:00 H 0105

Entscheidungszwänge in der Weltenergieversorgung und Klimapolitik bei hoher Unsicherheit — •Carl Christian von Weizsäcker — MPI for Research on Collective Goods, Bonn

Das Bewusstsein für die Notwendigkeit weltweiten (kollektiven) Handelns bei der Begegnung existentieller Risiken ist im Vergleich zu früheren Jahrhunderten durch das umfassendere wissenschaftliche Verständnis der Kausalbeziehungen wesentlich stärker ausgeprägt. Besondere Beachtung findet gegenwärtig die Klimaproblematik und, damit verbunden, die Energiepolitik.

Als Konsequenz von Fukushima scheint die Wahrnehmung existentieller Risiken verschoben. Wie ernst meinen es diejenigen mit der Klimapolitik, die den Beitrag der Kernenergie zur Verminderung der Treibhausgas-Emissionen heute für verzichtbar halten? Kernenergie ist nur ein Teilaspekt, aber welche Schlussfolgerungen muss man aus der "Revealed Preference" dieser Bürger für eine nach konsistenten Kosten-Nutzen-Kriterien aufgebaute Energie-Politik ziehen? Für wie entscheidend wird die Bekämpfung des Klimawandels tatsächlich gehalten?

Ein Seitenblick auf die Rolle des IPCC, des offiziellen Ratgebers der Politik, hinsichtlich "Wissen", "Ideologie" und Herrschaftsanspruch in der öffentlichen Meinungsdefinition ist zweckmäßig. Natürlich fordert das "Precautionary Principle", pessimistische Prognosen stärker als optimistische zu gewichten, jedoch müssen in einer Gesamtbilanz neben Klimastabilität auch andere Güter mit in die Bewertung einbezogen werden.

Wie geht es mit einer weltweiten Klima-Konvention weiter? Der Kyoto-Ansatz scheint gescheitert. Können Forschungsvereinbarungen für Techniken, die die Stabilisierung des Klimas erleichtern, weiter führen? Geo-Engineering?

Ein Erfolg der Eindämmung des Klimawandels als globale Politik ist jedenfalls nicht gesichert. Deshalb muss verstärkt über Anpassung an den Klimawandel nachgedacht werden. Anpassung kann vielfach mit Erfolg lokal, national oder regional betrieben werden. Sind, wie von Stern angenommen, die Kosten des Klimawandels tatsächlich größer als die der Eindämmung des Klimawandels? In wie weit hängt dies von den angenommenen Szenarien und Berechnungsmethoden des Gegenwartswerts zukünftiger Aufwendungen ab?

Die Sinnhaftigkeit einer europäischen Vorreiter-Rolle bei Klimaschutz, Energiewende und Abkehr von Kernenergie misst sich am globalen Erfolg. Unter Verweis auf das Klimaparadox von H.W. Sinn: Wenn trotz Fukushima zwar in Europa die fossile Energienutzung abnehmen sollte, aber dadurch gleichzeitig ein stärkeres wirtschaftliches Wachstum im Rest der Welt einen entsprechend höheren globalen Verbrauch fossiler Energieträger bewirken würde, wäre für den Klimaschutz wenig gewonnen.

Panel Discussion 11:30–12:00

"Fukushima und die Konsequenzen" Gerald Kirchner, Joachim Knebel, Gerhard Proehl, Carl Christian von Weizsäcker; Moderation: Hardo Bruhns

UP 5: Fachverbandstreffen

Time: Wednesday 12:30–13:30 Location: HFT-FT 131

Mitgliederversammlung (mit Mittagsimbiss)

UP 6: Lecture by Martin Heimann on carbon cycle

Time: Wednesday 14:00–14:45 Location: HE 101

Keynote Talk UP 6.1 Wed 14:00 HE 101

The global carbon cycle in the climate system: To which extent is it manageable? — •Martin Heimann — Max-Planck-Institute for Biogeochemistry, Jena, Germany

Only about ~50% of the anthropogenic emissions of the greenhouse gas carbon dioxide (CO2) from the burning of fossil fuels and cement production currently accumulates in the atmosphere. The remainder is taken up by carbon sinks in the ocean and on land. Hence the dynamics of these sinks are crucial for the future evolution of the atmospheric CO2 content and its climate impact. The global ocean CO2 sink is relatively well understood and can be quantified by several independent methods. The global land sink is caused by the difference between pho-

tosynthesis of the vegetation and respiration from plants and soils. It can be quantified as a remainder of the atmospheric budget, however, the underlying complex dynamics of the land vegetation and soils are still quite uncertain on a global scale. This limits our predictions of how these natural sinks will continue to operate in the future. Under high CO2 concentrations modest saturation effects in the ocean and on land are expected, which will be further exacerbated by detrimental effects from a warming climate (a.o. ocean outgassing, enhanced soil respiration). The fate of the land sink in the 21st century, however, will be dominated by direct and indirect anthropogenic impacts from changes in land use and management caused by an increasing world population with food demands and associated land reclamation. This leaves little room for land management activities specifically directed to sequester excess carbon e.g. large-scale afforestation, biomass burial, biochar formation or changes in soil tillage. Also, other proposed "geoengineering" options to foster carbon sinks (e.g. ocean fertilization), have a very limited potential for carbon sequestration in comparison to the expected emissions from fossil fuels during this century.

UP 7: Cryosphere, Hydrosphere and Oceanography

Time: Wednesday 15:00–17:15 Location: HFT-FT 131

Invited Talk UP 7.1 Wed 15:00 HFT-FT 131

Uncertainties of sea ice thickness estimates from SMOS radiometry and CryoSat-2 synthetic aperture radar altimetry — •Lars Kaleschke, Nina Maass, and Xiangshan Tian-Kunze — Institut für Meereskunde, KlimaCampus, Universität Hamburg

Sea ice plays an important role in the climate system. Firstly, it is considered as an early indicator of climate change because of the amplification of climatic variations in the polar regions. Secondly, sea ice is involved in the processes that drive the polar amplification and has a potential global impact on climate. The uncertainties of sea ice thickness estimates are of particular relevance for analysing the reliability of climate models.

Data from the recently launched ESA satellites CryoSat-2 and SMOS can be used to estimate sea ice thickness. Although both sensors take advantage of a synthetic aperture principle, they do provide complementary information. CryoSat-2 measures the elevation of the sea ice surface, the so-called freeboard, with an active radar system. The sea ice thickness can be inferred from the freeboard with several assumptions, e.g. about sea ice density and the backscatter horizon within the snow surface. SMOS measures the thermal radiation at a wavelength of 21 cm. Electromagnetic radiation with this long wavelength emerges from the ice-ocean interface and can be used to infer the sea ice thickness with assumptions about the ice temperature and salinity that affect the penetration depth and emissivity. In this presentation we will give an overview of the methods and the associated uncertainties for deriving sea ice thickness from SMOS and CryoSat-2.

UP 7.2 Wed 15:30 HFT-FT 131

Remote sensing of snow on sea ice — Christian Melsheimer and •Georg Heygster — Institut für Umweltphysik, Universität Bremen

Snow on sea ice significantly reduces the heat flow between the ocean and the atmosphere and thus influences the thickness growth and melting of sea ice. Furthermore, snow on sea ice considerably increases the friction of ice-going ships. Therefore, snow on sea ice is an important quantity for modeling and predicting sea ice, and because of the inaccessibility of most of the sea ice, remote sensing methods are necessary for investigating it. Here, we want to estimate the thickness of the snow layer on sea ice using satellite instruments, namely microwave radiometers, microwave scatterometers and optical sensors.

The base is an algorithm that uses the influence of the snow layer on the thermal microwave emission by the underlying sea ice at 19 and 37 GHz. This algorithm, however, is applicable to level first-year ice under non-melting conditions. To mask out areas where these conditions are not met, the radar backscatter at 5.3 GHz can be inspected as it is increased in melting conditions and for rough ice.

We present first results of implementing this algorithm in an operational processing chain for sea ice concentration and compare with some in-situ measurements.

Invited Talk UP 7.3 Wed 15:45 HFT-FT 131

Oceanographic measurements in Fram Strait – a gateway to the Arctic Ocean — •Florian Greil, Agnieszka Beszczynska-Möller, and Ursula Schauer — Alfred Wegener Institut (AWI) für Polar- und Meeresforschung, D-27515 Bremerhaven, Germany

The Fram Strait is a 500 km wide passage between Greenland and Svalbard. It is is the unique deep water connection between the Arctic Ocean and the North Atlantic. Arctic surface waters flow southward in the East Greenland Current and carry sea ice out of the Arctic. The West Spitsbergen Current (WSC) flows northward and brings relatively warm and saline waters into the Arctic. The WSC is the northern extension the Norwegian Atlantic Current which in turns originates in the Gulf Stream. They are the only oceanic source of heat for the Arctic Ocean and may thus affect the sea ice cover. Other possible mechanisms for the declining ice cover will also be presented.

The Alfred Wegener Institute maintains a an array of moored instruments at 78.8°N since the mid 1990s. The instruments acquire temperature and current data over the whole year. Our data reveals a warming (of approximately 1°C from 1997 to now) of the Atlantic water inflow. On monthly to decadal time scales, we also observe a great variability of the oceanic fluxes.

UP 7.4 Wed 16:15 HFT-FT 131

Plausibility and Stability of Models for Dissolved Noble Gases in Groundwater — •Werner Aeschbach-Hertig, Florian Freundt, Michael Jung, and Martin Wieser — Institut für Umweltphysik, Universität Heidelberg , 69120 Heidelberg

Several models describe dissolved noble gases in groundwater and the phenomena of excess air and degassing. The classical explanation for excess air is that air bubbles are entrapped during infiltration and subsequently completely dissolved. This "unfractionated air" (UA) model is hard to reconcile with the amount of entrapped air and the available pressures in soils. Models based on diffusive fractionation are in conflict with the absence of isotope fractionation. The "oxygen depletion" (OD) model postulates an increase of noble gas partial pressures in soil air as a result of oxygen consumption. Recent experiments have demonstrated this effect to be seasonally restricted and rather weak.

The "closed-system equilibration" (CE) model assumes that trapped air bubbles reach solubility equilibrium with groundwater at the local pressure. We find this model to provide the most physically realistic description of the gas - groundwater interaction. The flexible CE model includes both excess air and degassing and encompasses the UA model as well as a pressure effect similar to the OD model as limiting cases. The downside of this versatility is its tendency towards numerical instability. Occasionally solutions with clearly unrealistic parameter values occur, which produce a warm bias and large uncertainties of estimated temperatures. In some cases it appears possible to find corresponding well-behaved solutions of the model.

UP 7.5 Wed 16:30 HFT-FT 131

Seen als Quelle atmosphärischen Methans: Bedeutung von räumlich und zeitlichen Skalen für die Abschätzung der Emissionen — •Hilmar Hofmann — Arbeitsgruppe Umweltphysik, Limnologisches Institut, Universität Konstanz, Mainaustr. 252, 78464 Konstanz

Seen sind eine bedeutende Quelle atmosphärischen Methans, aber die seeinternen Frei- und Ausbreitungspfade sind unklar. In oxischen Wasserkörpern sind die Sedimente der Flachwasserzonen (Litoral) aufgrund der höheren Wasser- (Sediment) Temperaturen im Vergleich zu den Sedimenten des Profundals hochproduktiv. Zusätzlich sind die Sedimente des Litorals regelmäßig durch Oberflächenwellen gestört, die den Porenwasseraustausch befördern oder die Sedimentoberfläche durch Resuspension aufbrechen. Im oligotrophen Bodensee wurden verschiedene Messkampagnen zur Methanfreisetzung und -verteilung von gelöstem Methan zwischen dem Litoral und Pelagial (Freiwasser) durchgeführt. Diese Messungen zeigten die Bedeutung von Oberflächenwellen und der Wassertemperatur für die Dynamik und die Menge an freigesetztem, gelöstem Methan im flachen Litoral. Die gelösten Methankonzentrationen im flachen Litoral waren immer höher als die des Pelagials. Das

Litoral stellt deswegen eine bedeutende Quelle für das seeweit gelöste Methan dar. Die seeweite Verteilung von gelöstem Methan ist mit der Wassertemperatur, der Strömung und der Seemorphometrie korreliert und zeigte große räumlich-zeitliche Heterogenitäten. Diese haben einen bedeutenden Einfluss auf die tatsächlichen, seeweiten Emissionen, sind aber in den bisherigen Bilanzen nicht berücksichtigt.

30 min coffee break

UP 8: Methods 1

Time: Wednesday 17:15–18:30 Location: HFT-FT 131

Invited Talk UP 8.1 Wed 17:15 HFT-FT 131

From fs-LIDAR Sensing of the Atmosphere to fs-Optical Control — •Ludger Woeste[1], Kamil Stelmaszczyk[1], Roland Sauerbrey[3], Jerome Kasparian[2], and Jean PierreKamil Wolf[2] — [1]Institut für Experimentalphysik, Freie Universität Berlin, Arnimallee 14, 14195 Berlin, Germany — [2]Université de Genève, GAP-Biophotonics, 1211 Geneva 4, Switzerland — [3]Helmholtz Forschungszentrum Dresden-Rossendorf, 01328 Dresden, Germany

When launching sufficiently powered femtosecond laser pulses into the atmosphere, we observed extended (fs) bundles of white light emitting plasma filaments, which extended over km lengths. Their formation is based on a fascinating interplay of non-linear optical processes like Kerr-lensing, plasma-defocusing and self-phase modulation. The filaments emit directional white light in a wide spectral range from the IR to the UV, which allows the remote and simultaneous analysis of a rich variety of gaseous atmospheric constituents. Further, when they hit solid or liquid targets, they emit intensive characteristic plasma light, which allows the remote identification of soil, vegetation, waters and even radioactive isotopes deposited there on. Most interesting properties result from the electrical conductivity of such bundles of plasma-filaments. The effect allows not only to guide and control electric discharges and currents; it even provides a realistic chance to trigger lightning and to assist or initiate water condensation in the remote atmosphere.

UP 8.2 Wed 17:45 HFT-FT 131

How accurately can we calibrate an SO_2 camera? — •Peter Lübcke, Nicole Bobrowski, Sebastian Illing, Leif Vogel, and Ulrich Platt — Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg

SO_2 fluxes start to be monitored at a considerable number of volcanoes for volcanic risk assessment. The SO_2 camera, based on a 2-D UV sensitive CCD and two band-pass interference filters, is an instrument for remote sensing of volcanic emissions based on measuring the ultraviolet absorption of SO_2 in a narrow wavelength window around 310 nm. A second wavelength interval around 330 nm is used to correct for broad band absorption effects and Mie scattering. To obtain correct SO_2 fluxes that can be compared to other measurement techniques and used for volcanological models, it is important to calibrate the SO_2 camera carefully. Today, the most common approach for calibration is measurements using calibration cells of known concentration, neglecting effects that can occur due to aerosols (e.g., ash) in the volcanic plume. We present results from a case study at Popocateptl, Mexico, 2011, where we calibrated the SO_2 camera with a coaxial Differential Optical Absorption Spectroscopy (DOAS) system. We compare the calibration cell approach to the DOAS calibration method and verify the respective results with measurements from an Imaging Differential Optical Absorption Spectroscopy System (IDOAS). We will discuss the general advantages and limitations of an SO_2 camera and under which conditions the calibration cell method might fail and possibly lead to wrong conclusions about the SO_2 emission flux.

UP 8.3 Wed 18:00 HFT-FT 131

Klassifizierung von Pflanzen für spektroskopische Satelliten-Fernerkundung — •Tobias Mahr[1,2], Eva Peper[1], Denis Pöhler[1], Ulrich Platt[1] und Thomas Wagner[1,2] — [1]Institut für Umweltphysik, Heidelberg — [2]Max-Planck Institut für Chemie, Mainz

DOAS (Differentielle Optische Absorptions-Spektroskopie) erlaubt die Bestimmung von Spurengaskonzentrationen an Hand ihrer charakteristischen Absorptionsstrukturen. Seit 1995 wird dieses Verfahren auch erfolgreich in satellitengestützten Experimenten wie GOME, GOME-2 und SCIAMACHY zur weltweiten Messung stratosphärischer und troposphärischer Gase eingesetzt, beispielsweise von Ozon und Stickoxiden. Jedoch werden in der Auswertung bislang spektrale Signaturen des Erdbodens, von dem ein großer Teil des Sonnenlichts reflektiert wird, vernachlässigt. Dies kann zu Fehlern in der Spurenstoffbestimmung führen, bietet jedoch auch die Möglichkeit, Erdoberflächen sowie verschiedene Gruppen von Vegetation zu identifizieren. Zur Untersuchung dieses Einflusses wurden hochaufgelöste Reflexionsspektren (FWHM von 0,29 nm) von 95 Pflanzen und anderen natürlichen Erdoberflächen zwischen 350 und 1050 nm vermessen. Eine Klassifizierung erfolgte gemäß der biologischen Systematik (Unterabteilung, Klasse, Ordnung, Gattung, ranglose Einteilung), Verbreitung (Kontinente, Klimazonen), Photosyntheseart (C3, C4, CAM) und Umweltbedingungen.

UP 8.4 Wed 18:15 HFT-FT 131

Microwave transmission: A new tool for remote sensing precipitation and humidity — •Christian Chwala[1], Uwe Siart[2], Andreas Gmeiner[1], Susanne Hipp[2], and Harald Kunstmann[1] — [1]Karlsruher Institut für Technologie, Institut für Meteorologie und Klimaforschung - Atmosphärische Umweltforschung (IMK-IFU), Garmisch-Partenkirchen — [2]Lehrstuhl für Hochfrequenztechnik, Technische Universität München

Recent high resolution models for weather forecast and hydrology need precise observation data of precipitation and humidity to allow for correct initialization and validation. We present a new technique which uses both attenuation and phase shift data of microwave transmission through the atmosphere, aiming to complement and thus to improve the established methods using station and weather radar data.

For line integrated precipitation observation we analyze attenuation data from commercial microwave backhaul links around Garmisch-Partenkirchen. Because of severe fluctuations even during dry periods, we introduce an algorithm based on spectral time series analysis to distinguish between rainy and dry periods. After processing, comparison with rain gauge and weather radar data shows good correlation.

Additionally, we operate a dual frequency (22.235 GHz and 34.8 GHz) and dual polarization transmission experiment at a hydrometeorological test site in the TERENO pre-alpine observatory. Besides attenuation data its coherent monostatic configuration provides very precise phase information. This allowed us to derive very fast line integrated measurements of absolute humidity.

UP 9: Poster session

Time: Wednesday 18:30–19:15 Location: Poster F

UP 9.1 Wed 18:30 Poster F

Dichte von Seewasser — •Bertram Boehrer[1], Severine Dietz[1,2,3] und Dieter Lessmann[2] — [1]Helmholtz Zentrum für Umweltforschung UFZ, Magdeburg — [2]BTU Cottbus, Lehrstuhl für Gewässerschutz — [3]Bjoernsen Beratende Ingenieure, Koblenz

Kleine Dichteunterschiede im Promillebereich kontrollieren Strömungsvorgänge in geschichteten Seen. Direkte Messungen erreichen nicht die benötigte Genauigkeit. Deshalb ist man auf indirekte Methoden, z.B. durch Messung von elektrischer Leitfähigkeit und Temperatur angewiesen. Solche Formeln sind von der chemischen Zusammensetzung der gelösten Stoffe abhängig. Es werden Ansätze zur Dichtebestimmung in Seen vorgestellt basierend auf Messung der elektrischen Leitfähigkeit bzw. der chemischen Zusammensetzung. Am Ende wird ein See vorgestellt bei dem reaktive Substanzen die Dichteschichtung ausmachen,

und der spezifische Anteil zur Schichtung wird quantitativ ermittelt.

UP 9.2 Wed 18:30 Poster F

Saisonalität des Brechens und der Brechungsmechanismen interner Solitärwellen — •Martina Preusse[1], Marek Stastna[2], Heinrich Freistühler[1] und Frank Peeters[1] — [1]Universität Konstanz, Deutschland — [2]University of Waterloo, Kanada

Mehr als 200 Züge von internen Solitärwellen (ISWn) mit Amplituden zwischen drei und dreißig Metern wurden in der Mitte eines Nebenbeckens des Bodensees beobachtet und analysiert. Gemessene Amplitude und Stabilität der führenden ISWn dieser Wellenzüge und deren Saisonalität werden mit den Grenzamplituden und Brechungsmechanismen verglichen, die mittels der Dubreil-Jacotin-Long Gleichung simuliert wurden. Das Auftauchen von ISWn mit Amplituden, die ihre simulierte Grenzamplitude überschreiten, ist sehr gut mit der Beobachtung von Temperaturinversionen korreliert. Diese gute Korrelation deutet darauf hin, dass die simulierte Grenzamplitude die kritische Wellenhöhe, über der ISWn im Feld brechen, exzellent vorhersagt. Die statistische Analyse der beobachteten Welleneigenschaften in Kombination mit den numerischen Simulationen zeigt, dass sich die Wahrscheinlichkeit des Wellenbrechens und der Brechungsmechanismen mit der Jahreszeit ändern.

UP 9.3 Wed 18:30 Poster F

Ein neuartiger fraktionierungsfreier Regensammler und seine praktische Anwendung auf die massenspektrometrische Isotopenanalyse von Niederschlägen an der oberen Adria — Manfred Gröning[1], •Hans Lutz[2,3], Zvjezdana Roller-Lutz[3], Martin Kralik[4] und Laurence Gourcy[5] — [1]Internationale Atomenergiebehörde IAEA, Abteilung Terrestrische Umwelt, Wien/Seibersdorf — [2]Universität Bielefeld, Fakultät für Physik, Bielefeld — [3]Universität Rijeka, medizinische Fakultät, Rijeka, Kroatien — [4]Umweltbundesamt Österreich, Wien — [5]BRGM Orleans, Frankreich

Eine wesentliche Einflussgrösse für das Wassermanagement einer Region sind die Niederschläge als Input in das Wasserfließsystem. Standardisierte *offene* Sammler, wie sie allgemein in der Meteorologie Verwendung finden, haben bei der Bestimmung der isotopischen Zusammensetzung grosse Fraktionierungsprobleme. Dagegen sind Sammler, in denen die Niederschläge durch eine dünne Paraffin-Ölschicht bedeckt sind, zwar besser geeignet aber recht unbequem zu benutzen. In einer internationalen Kooperation haben wir deshalb einen ölfreien Niederschlagssammler entwickelt. Er zeigt sehr gute Performance bei einfacher Handhabung und Verhinderung jeglicher signifikanten Isotopenfraktionierung. Wir haben dieses Gerät eingesetzt, um die isotopische Zusammensetzung δ18O and δ2H der Niederschläge an der oberen Adria zu messen. Wegen der interessanten Geomorphologie der Region (z.B. Berge bis zu 1400 m direkt neben dem Meer) konnte auch der isotopische Höheneffekt bestimmt werden.

UP 9.4 Wed 18:30 Poster F

Universal constants and equations of turbulent motion — •Helmut Ziegfeld Baumert[1] and Hartmut Peters[2] — [1]IAMARIS, Hamburg, Germany — [2]Earth and Space Research, Seattle, USA

We present turbulence in analogy with the kinetic theory of gases, with dipoles made of vortex tubes as frictionless quasi-particles. Their chaotic movements are governed by Helmholtz' elementary vortex rules applied locally. Contact interactions lead either to random scatter or to the formation of likewise rotating, fundamentally unstable whirls. We predict von Karman's constant as 1/sqrt(2 pi) = 0.399 and the spatio-temporal dynamics of energy-containing time and length scales of turbulent mixing according to experiments. The above image is compatible with Kolmogorov's turbulence spectra as dissipative patches of locally space-filling bearings in the sense of Herrmann [1990]. For steady and locally homogeneous conditions our approach predicts the dimensionless pre-factor in the 3D Eulerian wavenumber spectrum as 1.8. In the Lagrangian frequency spectrum we find the integer 2. Our results improve the understanding of stratified laboratory and geophysical flows significantly. In the neutrally geophysical case our derivations are completely free of empirical relations and rest on geometry, methods from many-particle physics, and on elementary conservation laws only. In the stably stratified geophysical case the role of internal gravity waves is taken into accout using the universal mixing efficiency and, for the strength of the wave field, one site-specific empirical parameter.

UP 9.5 Wed 18:30 Poster F

Modeling the morphogenesis of brine channels in sea ice — Silke Thoms[1], •Bernd Kutschan[2], Klaus Morawetz[2,3], and Sibylle Gemming[4] — [1]Alfred Wegener Institut, Am Handelshafen 12, D-27570 Bremerhaven, Germany — [2]Münster University of Applied Sciences, Stegerwaldstrasse 39, 48565 Steinfurt, Germany — [3]International Institute of Physics (IIP) Av. Odilon Gomes de Lima 1722, 59078-400 Natal, Brazil — [4]Helmholtz-Zentrum Dresden Rossendorf, PF 51 01 19, 01314 Dresden, Germany

The brine channel web in sea ice as biotope for microorganisms acts as an important CO_2 sink of about 18% of the annual primary carbon production in ice-covered Southern Ocean. Two mechanisms of brine channel formations are represented. The structure of ice, the tetrahedricity, and the salinity are identified as coupled order parameters and their evolution equations are derived invoking conservation laws. The stability analysis provides the phase diagram where brine channels can be formed. In thermodynamics the parameters determine the supercooling or superheating region and the specific heat respectively. In contrast to the Turing model the diffusivity does not enter this phase diagram but determines only the structure size. The numerical solution shows a short-time behavior of structure formation where the freezing is assumed and a large-time broadening of the structure. The structure and freezing parameters as well as diffusivity are extracted from experimental values of water and ice. With the help of these realistic parameters the brine channel distribution is calculated and found in agreement with the measured samples.

UP 9.6 Wed 18:30 Poster F

SCIAMACHY nadir ozone profiles in comparison with limb measurements — •Stefan Bötel, Mark Weber, Alexei Rozanov, and John P. Burrows — Institute of Environmental Physics, Universität Bremen, 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. 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 ozone profiles from SCIAMACHY nadir profile retrieval will be compared with profiles retrieved in limb geometry and the effects of different types of spectral calibration will be shown.

UP 9.7 Wed 18:30 Poster F

Retrieval of Atmospheric Aerosol and Trace Gas Profiles using MAX-DOAS — •S. Yilmaz[1], U. Friess[1], U. Platt[1], A. Apituley[2], R. van der A[2], A. Piters[2], and B. Henzing[3] — [1]IUP, University of Heidelberg, Germany — [2]KNMI, De Bilt, The Netherlands — [3]TNO, Utrecht, The Netherlands

Aerosols and trace gases are key components of the physical and chemical processes in the atmosphere. The observation of these components is crucial for the improvement of numerical models used for the prediction of atmospheric composition and climate. Therefore, novel techniques are desirable, which allow for comprehensive observations in worldwide networks. In the recent years, remarkable advances in the application of the Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) technique for the retrieval of atmospheric aerosol and trace gas profiles have been made. The approach of combining MAX-DOAS trace gas measurements with advanced numerical inversion methods allows for the height resolved determination of the constituents in the lower troposphere.
We report on comparisons of aerosol extinction profiles retrieved from MAX-DOAS observations with LIDAR and in-situ measurements. Additionally, the comparison of NO_2 profiles retrieved from MAX-DOAS with satellite and in-situ measurements is presented. The independent datasets are generally highly correlated and show very good agreement. We conclude that MAX-DOAS is a powerful tool, which is highly suited for cost-effective and automated remote sensing measurements and the integration in networks for atmospheric composition observations.

UP 9.8 Wed 18:30 Poster F

Monte Carlo Strahlungstransportmodellierung für passive optische UV/vis/NIR Fernerkundung — •Tim Deutschmann und Ulrich Platt — Im Neuenheimer Feld 229, 69120 Heidelberg,

Deutschland

Bei der Auswertung von UV/vis/NIR Streulichtspektren in Hinblick auf die Konzentration gasförmiger Absorber wie z.B. O_3, NO_2 oder SO_2 entlang des Lichtwegs hat sich die DOAS Analyse etabliert. Für die weitergehende Interpretation der DOAS Ergebnisse werden Strahlungstransportmodelle eingesetzt um räumliche Konzentrationsprofile von Spurengasen zum Zeitpunkt der Messung zu rekonstruieren. Speziell benötigt man für die entsprechenden Schichten der Atmosphäre der Messung zugehörige Gewichtungsfunktionen des Schichtabsorptionskoeffizienten. Es wird ein stochastisches Verfahren zur Lösung der Strahlungstransportgleichung, seine Anwendung im Kontext der Inversion von atmosphärischen Parametern sowie eine weitergehende Anwendungsmöglichkeit präsentiert. Wir zeigen in Bezug auf die Inversion dreidimensional aufgelöste Gewichtungsfunktionen, sowie als weitere Anwendung des Modells die Berechnung der diffusen solaren Einstrahlung an unterschiedlichen Flächen der Gebäude einer Großstadt.

UP 9.9 Wed 18:30 Poster F

Validation of MAX-DOAS aerosol and trace gas measurements under various cloud conditions — •X. Li[1], T. Brauers[1], B. Bohn[1], U. Löhnert[2], J. Schween[2], S. Crewell[1], and A. Wahner[1] — [1]Institut f. Energie u. Klima, IEK-8, Forschungszentrum Jülich — [2]Institut f. Meteorologie u. Geophysik, Universität Köln

Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) is a remote sensing technique for the measurements of aerosol and trace gases such as formaldehyde (HCHO), glyoxal (CHOCHO), and nitrogen dioxide (NO_2) in the atmosphere. Despite the simplicity of the experimental setup of MAX-DOAS, the accurate retrieval of aerosol and trace gas profiles from the MAX-DOAS scattered sunlight measurements requires radiative transfer models to simulate the photon paths in the atmosphere. Generally good agreement was found between MAX-DOAS and in-situ techniques measuring aerosol extinction and trace gas concentrations during field experiments. However, most of the intercomparisons were performed under clear sky conditions in which the influence of clouds is marginal. Within the framework of JOYCE (Joint ObservatorY of Cloud Evolution), a MAX-DOAS instrument is setup side by side with instruments measuring cloud properties, aerosol profiles, trace gases, and meteorology parameters on the roof of a building in Jülich. With this setup quantitative evaluation of the influence of clouds on the accuracy of MAX-DOAS aerosol and trace gas measurements is intended. Moreover, it is also foreseen to investigate which cloud information can be derived from the MAX-DOAS observations.

UP 9.10 Wed 18:30 Poster F

CO2 Emission Monitoring using GPS equipped smartphones — •Ralf Willenbrock[1] and Dennis Horch[2] — [1]Deutsche Telekom RO China, Beijing, P.R. China — [2]GIZ China, Beijing, P.R. China

After 2009th visit of German Environment Ministry to China attending the third Sino-German Environment Summit in Foshan (P.R. China), GIZ and Deutsche Telekom Group initiated two Public Private Partnership Projects to support Climate Protection in Transportation by using GPS based Smartphone technology. Promising results could be presented live during Shanghai EXPO 2010, where 50 BMW VIP shuttle monitored the CO2 emissions around the Shanghai World EXPO area online. Many German automotive and logistics companies, e.g. BMW, EDAG and DB Schenker supported the initiative and GIZ received strong support from Chinese Enviromental Protection Agencies and Universities working in the field of Transportation and Enviromental Sciences. In this paper we would like to present first field trial results and how such advanced technology could be used in the near future to improve Emission Monitoring, urgently needed in Asia's fast growing Mega-Cities.

UP 9.11 Wed 18:30 Poster F

Estimating the Rate and Intensity of Precipitation Events with regard to Scaling Behavior of a Gamma Process — •Jan Micha Steinhäuser — University of Oldenburg, Germany

The gamma distribution is comparatively well-suited for the description of the amount of rainfall occurring daily and monthly. Thus, it is possible to simulate the cumulative rainfall by a gamma process. Doing so, the mean and the variance of rainfall should show a linear scaling behavior with regard to the length of observation time. In Germany this linear scaling behavior is observable for timescales longer than approx. 20 days. It is possible to construct this gamma process with a Poisson Process on $\mathbb{R}^2$. Then, a factorization into two independent processes allows describing the temporal occurrence of rainfall events and the intensity of the individual events separately.

Using this method, it is now possible to show how rainfall events that last longer than the observation interval distort the statistics of rainfall rate and intensity, as long-lasting events are split up and counted several times. This interpretation allows explaining how stochastic precipitation models based on measurements that are to short-period compared to the duration of rainfall events (e.g. daily) overestimate the rate and underestimate the intensities of rainfall events.

As the use of gamma processes suffers from a lack of physical justification and cannot be used to explain scaling properties precisely, further options of modeling the intensities of rainfall events are discussed.

UP 9.12 Wed 18:30 Poster F

Eine neue, physikalische Erklärung für den Untergang der Titanic — •Mathias Schmitz — Sitzbuchweg 30, 69118 Heidelberg

Die Titanic erzeugte jeweils im Bugbereich wie auch im Heckbereich einen Wellenberg mit einem Wellental dazwischen. Die Bug- und Heckwelle interferieren in Resonanz, bedingt durch die Rumpfform. Jede Welle hat eine Wellenlänge von ca. 125 Meter, zusammen 250 Meter. Die Titanic war 267 Meter lang mit einem Tiefgang von 10,50 Meter. Der mittlere Teil des Schiffes lag in einem Wellental. Die Wellenhöhe beträgt bei Wasserwellen ein 1/12 der Wellenlänge, das sind 10,05 Meter. Ferner weist jede Wasserwelle eine Wellen- oder Ausbreitungsgeschwindigkeit auf. Bestimmt man diese Wellengeschwindigkeit v aus der Wellenhöhe h mit Hilfe der Bernoulligleichung (p0 = 0 Pa)zu : v = Wurzel(2*h*9,82 m/s2) mit pw = 1000 kg / m3 * h *9,82 m/s2 und die Wellenlänge CWL aus der technisch bekannten Formel für die Rumpfgeschwindigkeit: v = 2,43 * Wurzel (CWL) , so stellt man fest, dass die Rumpflänge das 12 fache der Bernoullitiefe ist. Die Titanic war 25 Knoten (13 m/s) schnell, eine 10 Meter hohe Wasserwellen ist 14 m/s schnell. So hat die Wellengeschwindigkeit der Bug- und Heckwelle die Geschwindigkeit der Titanic erreicht. Die besondere Belastung im mittleren Schiffsbereich und der erhöhte Wasserwiderstand durch den "Überschalleffekt" verursachten eine besondere Belastung auf den Schiffsrumpf. Die Matrosen im Ausguck berichteten von einer ungewöhnlich ruhigen See, die Wassertemperatur wurde zu -4 Grad Celsius gemessen. Das ruhige Wasser ohne Wellen ermöglichte eine besonders schnelle Schiffsgeschwindigkeit.

UP 9.13 Wed 18:30 Poster F

Herkunftsbestimmung von Innenraumschadstoffen mittels Beschleunigermassenspektrometrie — •Matthias Schindler[1], Wolfgang Kretschmer[1], Andreas Scharf[1], Karin Kritzler[1], Alexander Stuhl[1] und Ewald Hannappel[2] — [1]Physikallisches Institut (KORA), Uni Erlangen, Erwin-Rommel-Str. 1, 91058 Erlangen — [2]Institut für Biochemie, Emil-Fischer Zentrum, Fahrstraße 17, 91054 Erlangen

Mit Hilfe der ^{14}C-Methode ist es möglich, rezente und fossile Proben anhand ihres ^{14}C-Gehalts zu unterscheiden. Diese Methode eignet sich auch, um Umweltschadstoffe auf ihren Ursprung zu untersuchen. Umweltschadstoffe können sich durch ihre allergene und kancerogene Wirkung zeigen. Um die Quellen der Schadstoffe abzuschaffen, ist es nötig, ihren Ursprung zu bestimmen.
In dieser Arbeit wurde das Augenmerk auf Aldehyde und Ketone gelegt. Da diese gasförmigen Stoffe zum Messen in die flüssige oder feste Phase gebracht werden müssen, ist eine Derivatisierung nötig. Da bei Derivatisierungen in der Regel Fremdkohlenstoffe ohne ^{14}C eingebracht werden, ändert sich das Isotopenverhältnis $^{12}C/^{14}C$, was zu einem erhöhten Messfehler führt.
In dieser Arbeit wurden deshalb verschiedene Derivatisierungen getestet. Dabei wurden sowohl klassische Reaktionen wie auch moderne Solventfreie Reaktionen als auch verschiedene Chromatographieverfahren (HPLC, GC und DC) getestet.
Es werden die Ergebnisse der verschiedenen Versuchsreihen, sowie erste Realdaten (biogen und anthropogen) vorgestellt.

UP 9.14 Wed 18:30 Poster F

Determination of noble gas temperatures on speleothems — •Tim Sander, Thomas Marx, Jürgen Engel, and Werner Aeschbach-Hertig — Institut für Umweltphysik, Universität Heidelberg, Germany

The solubility of noble gases in water is a function of temperature, salinity and their partial pressure in the gas phase. For known pressure and salinity, it is possible to determine the absolute temperature

at the time of isolation of the water from the air by measuring the concentrations of the dissolved noble gases. These so-called noble gas temperatures (NGTs) are already widely used for determining paleotemperatures from the groundwater archive. The application of this proxy to fluid inclusions in speleothems promises the additional advantage of a better time resolution combined with precise dating.

The main problems in determining well-defined NGTs on speleothems are the presence of air and the small amount of water incorporated in the calcite. Air inclusions in speleothems carry no temperature information and mask the temperature-relevant noble gas concentrations. A stepwise extraction technique was established to separate the water from the air-filled inclusions. A reasonably small calcite sample (about 1g) includes only about one microliter of fluid inclusion water, which demands a very accurate measurement of the corresponding small noble gas amounts. In order to show that it is possible to determine well-defined temperatures on such tiny samples, the setup was tested with very small air-equilibrated water samples (μAEWs), yielding reproducibilities better than 5% for all noble gases.

UP 9.15 Wed 18:30 Poster F

Detection of CO and N_2O in the exhaust of a combustion engine with a continuous wave, room temperature distributed-feedback quantum cascade laser — •Florian Schad[1], Wolfgang Elsässer[1,2], and Andreas Dreizler[2] — [1]TU Darmstadt, Institut für Angewandte Physik — [2]TU Darmstadt, Exzellenzcluster Center of Smart Interfaces

Carbon monoxide (CO) is a highly toxic trace gas in earth's atmosphere. It is a major pollutant which arises from incomplete combustion processes and is therefore an important indicator of combustion efficiency in the exhaust of cars. The concentration level of nitrous oxide (N_2O) in the exhaust gas is much lower than that of CO but recent investigations show an increased output of N_2O if three-way catalysts are used. To measure these molecules, we realized a sensor based on a cw, room temperature DFB quantum cascade laser (QCL) emitting at 4.56 μm. Around that wavelength are the fundamental transitions of CO and N_2O, with its high absorption line strengths, located.

We first present direct absorption measurements of the CO and N_2O sensor performed on gas samples in a 10cm cell. Due to the calibration-free method, the respective concentrations were directly calculated based on data of the HITRAN data base. The liquid-nitrogen cooled MCT-Detector guarantees for highly sensitive measurements, which results in a detection limit below 20 ppm. Then wavelength modulation spectroscopy results of N_2O are discussed with a detection limit of about 30 ppb. With this sensor concept we intend to measure the CO and N_2O concentrations directly in the exhaust of a diesel engine.

UP 9.16 Wed 18:30 Poster F

Towards traceability in concentration measurements using tunable diode laser based absorption spectroscopy — Javis Nwaboh, •Andrea Pogány, Pascal Ortwein, Olav Werhahn, and Volker Ebert — Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig, Germany

We have applied the TILSAM method, to achieve traceability in measuring concentration of trace gases by tunable diode laser absorption spectroscopy. The method promotes traceability and uncertainty assessment of spectrometric results, thereby improves reliability of the measured concentration data. Furthermore, it is an absolute, self-calibrating method, and thereby has the potential to become a primary method in gas analysis. Applying the TILSAM method eliminates the need for calibrating the instrument with high quality reference gas mixtures, preparation of which in the environmentally relevant concentration range is highly challenging.

We have validated the method through an inter-comparison measurement between two national metrology institutes. Both institutes measured CO2 concentration, in two gravimetrically prepared gas mixtures of CO2 in N2 in the environmentally relevant concentration range of 300-500 ppm, using the TILSAM method. Good agreement was found between results derived by the two institutes and the respective comparison reference values (degree of equivalence in the 1% range). The standard uncertainty and the repeatability of the spectrometric results were found to be 0.7% and 0.4%, respectively. The TILSAM method will be applied to environment related metrology projects.

UP 9.17 Wed 18:30 Poster F

Ein kompakter, lichtstarker UV-VIS-Spektrograph für die Differentielle Optische Absorptionsspektroskopie (DOAS) — •Friedrich Klappenbach, Ulrich Platt und Jens Tschritter — Institut für Umweltphysik Uni Heidelberg, INF 229, 69112 Heidelberg

Die Differentielle Optische Absorptions Spektroskopie (DOAS) ist eine seit bereits Jahrzehnten ausgereifte Methode, zum Nachweis atmosphärischer Spurenstoffe. Zentrales Messinstrument ist ein optischer Spektrograph der, Störparameter wie vaiirende Spaltfunktion oder Streulicht aufweisen kann. Auf diese Störparameter sind kommerzielle Spektrographen jedoch im allgemeinen nicht optimiert, sodass eine Verwendung dieser Spektrographen in hohen und somit schlechten Nachweisgrenzen bei der DOAS-Methode resultieren kann.

Ziel dieser Arbeit war es, speziell für die DOAS-Anwendung einen lichtstraken UV-Miniatur-Spektrographen zu entwickeln. Die Anforderungen an diesen Spektrographen sind, einen Spektralbereich von etwa 300-400 nm mit einer spektralen Auflösung von etwa 0,5 nm oder besser zu erreichen. Besonderes Augenmerk soll dabei auf die Störparameter wie Streulicht oder spektrale und zeitliche variation der Spaltfunktion gelegt werden.

Das bisherige Resultat, welches vorgestellt wird, zeichnet sich durch eine konstante, nahezu Gauss-Förmige Spaltfunktion und hohe Lichtstärke aus. Diese guten optischen Eigenschaften sind die Grundlage für eine Fortsetzung dieser Arbeit und weitere Optimierung im Hinblick auf Streulicht und Temperaturverhalten.

UP 9.18 Wed 18:30 Poster F

Aircraft measurements of anthropogenic NO_2 with an imaging DOAS instrument — •Anja Schönhardt, Patricia Altube, Andreas Richter, Sven Krautwurst, Konstantin Gerilowski, and John Burrows — IUP, University of Bremen, Germany

A new airborne imaging DOAS (Differential Optical Absorption Spectroscopy) instrument has been developed recently and is applied for the measurement of anthropogenic NO_2. The instrument is based on a grating spectrometer optimized for the visible wavelength region and uses entrance optics consisting of a wide angle objective and a light guide with sorted fibres. A broad spatial stripe below the aircraft distributed into several separate viewing directions is observed at the same time, and the instrument setup allows flexible positioning within the aircraft. The optical design as well as the spectral and spatial imaging characteristics are presented. First test flights and evaluations of NO_2 slant columns have been conducted and show a good performance. One presented example of application is the measurement of NO_2 in the exhaust plume of a power plant. The suitability for mapping of anthropogenic NO_2 on a small spatial scale ($\sim$100m) is demonstrated.

UP 9.19 Wed 18:30 Poster F

Referenzprobenfreie quantitative Röntgenfluoreszenzanalyse unter streifendem Einfall an deponierten Nanopartikeln — •Falk Reinhardt[1], Burkhard Beckhoff[1], Harald Bresch[2] und Stefan Seeger[2] — [1]Physikalisch-Technische Bundesanstalt (PTB), Abbestr. 2-12, 10587 Berlin — [2]Bundesanstalt für Materialforschung und -prüfung, Unter den Eichen 87, IV.24, 12205 Berlin

Durch die Vielzahl möglicher Quellen und Anwendungen kommen in immer höherem Maße Nanopartikel in unserer Umwelt vor. Damit wächst auch der Bedarf für zuverlässige quantitative Analysemethoden, die ohne Referenzproben auskommen, da die Anzahl verschiedener nanoskaliger Referenzmaterialien dem Bedarf immer weniger gerecht wird. Röntgenfluoreszenzanalyse unter streifendem Einfall (GIXRF) bietet bei Nachweisgrenzen im Femtogrammbereich die Möglichkeit, referenzprobenfrei quantitative und zerstörungsfreie Elementanalyse durchzuführen. Dabei kann zusätzlich das in dieser Messgeometrie auftretende stehende Röntgenwellenfeld (XSW) genutzt werden, um weitere Informationen über die Proben zu erhalten. Um die Zuverlässigkeit von GIXRF weiter zu verbessern, wurden im Laboratorium der PTB am Elektronenspeicherring BESSY II Messungen durchgeführt, um die Wechselwirkung der deponierten Partikel mit dem XSW genauer zu untersuchen. Dazu wurden verschiedene Nanopartikel größenselektiert und mit kontrollierter Massenbelegung aus der Aerosolphase auf Silizium-Oberflächen deponiert und energieabhängige Einflüsse auf die quantitativen Ergebnisse untersucht.

UP 9.20 Wed 18:30 Poster F

Development of an active alkaline trap to determine acidic gas ratios in volcanic plumes: sampling technique and analytical methods — •Julian Wittmer[1], Nicole Bobrowski[1], Marcello Liotta[2], and Ulrich Platt[1] — [1]IUP Heidelberg, Germany — [2]INGV Palermo, Italy

The study of the chemical interaction of volcanic gases with the at-

mosphere is an important issue to determine the volcanic gas composition when a diluted plume is sampled. Over the last years volcanic monitoring has been strongly influenced by optical measurement systems, whose development goes along with comparison to and is complemented by results of reliable and accurate direct sampling techniques. Besides Giggenbach bottles and filter packs, the alkaline trap is an established method to sample acid gas species.

The active alkaline trap, used in this work, is based on the principle of a Drechsel bottle to purify gas mixtures. A NaOH solution inside the bottle performs an acid-base reaction while the diluted volcanic gases are pumped through. To assess the concentration of the elements, the samples are analysed by titration and ion chromatography (IC). For higher sensitivity the analysis by IC-MS (IC coupled with mass spectrometry), ICP (Inductively coupled plasma)-MS and neutron activation is planned. The various methods will be compared and tested, using samples taken at Etna and Stromboli (Italy) in cooperation with the National Institute of Volcanology and Geophysics, Palermo, Italy. First results will be presented for the detection of carbon dioxide, sulphur, chlorine, fluorine, bromine and iodine.

UP 9.21 Wed 18:30 Poster F

Ice crystal growth from vapor phase - experiments in an electrodynamic balance — •Christiane Wender, Daniel Rzesanke, and Thomas Leisner — Karlsruhe Institute of Technology

Depending on the composition clouds can have a very different effect on the radiative forcing of the climate. The cloud particle microphysics is determining if shortwave sunlight is scattered back (cooling) or long wave earth radiation is trapped (warming). In this effect ice crystals in high cirrus clouds have an important role. Their shape and size defines the angle of backscattering and therefor also the amount of the cooling effect. [1]. We present an experiment which allows to observe the growth of individual ice crystals from the vapor phase within an electrodynamic levitator operating at variable supersaturation. The deposition freezing on microscopic AgI particles is observed in real time under a microscope, the mass change is detected with a Milikan balance. We present crystal growth rates and the dominant ice crystal morphology as a function of temperature and water vapor supersaturation over ice.

[1] Zhang, Y., Macke, A., & Albers, F. (1999). Effect of crystal size spectrum and crystal shape on stratiform cirrus radiative forcing. ATMOSPHERIC RESEARCH(52 (1-2)), S. 59-75.

UP 9.22 Wed 18:30 Poster F

Laboratory experiments on the nucleation and ice-growth of mesospheric dust particles — •Denis Duft, Markus Eritt, and Thomas Leisner — Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology, Karlsruhe, Germany

Meteoric Smoke Particles (MSP) are believed to be the basis for the formation of ice particles in the mesosphere. Under favorable conditions these particles can be observed from the ground as noctilucent clouds (NLC) and detected by radar as polar mesosphere summer echoes (PMSE). The occurence of these delicate ice particles can be used as a sensitive local probe for the otherwise elusive physical and thermodynamical conditions at the mesopause (80 – 90 km) and additionally to infer long term climatic trends in this height region. Despite of this importance, the microphysics of these mesospheric particles is not well understood. In this contribution we present laboratory experiments performed with the TRAPS apparatus on the nucleation and ice-growth of meteoric smoke particles under realistic mesospheric conditions. Charged composite-particles of SiO2, Fe2O3 und MgO (2 – 10 nm) are synthesized in a microwave reactor (100mbar), transferred directly into a vacuum chamber (10^{-7} mbar) using an optimized aerodynamic lens system and stored in a cooled linear ion trap (130 – 180 K). Nucleation and ice-growth on the trapped particles can be controlled by water vapor pressure adjustment and detected by *Cavity Enhanced Absorption Spectroscopy* (CEAS).

UP 9.23 Wed 18:30 Poster F

Untersuchung der heterogenen Eisnukleation von Wassertröpfchen auf wohldefinierten Einkristalloberflächen — •Sandro Di Natale[1,2], Isabelle Steinke[1], Thibault Hiron[3], Denis Duft[1] und Thomas Leisner[1,2] — [1]Institut für Meteorologie und Klimaforschung - Atmosphärische Aerosolforschung (IMK-AAF), Karlsruher Institut für Technologie (KIT) — [2]Institut für Umweltphysik (IUP), Ruprecht-Karls-Universität Heidelberg — [3]Département physique, École normale supérieure de Cachan

Die Bildung von Wolkeneis beeinflusst die Bildung des Niederschlags und die Lebensdauer und den Strahlungsantrieb von Wolken. Eis wird in der Atmosphäre meistens heterogen an Aerosolen gebildet, die als Eiskeime wirken können. Es ist bis heute kaum verstanden, was einen guten Eiskeim vor einem weniger guten auszeichnet oder welche auf atomarer Ebene die als Eiskeim wirksamen Strukturen sind. Wir präsentieren hier Laborexperimente, bei welchen das Gefrieren mehrerer tausend einzelner Wassertröpfchen auf wohl charakterisierten Einkristalloberflächen untersucht wird. Hierdurch kann die Eiswirksamkeit idealer Oberflächen quantifiziert und mit der von realen Aerosoloberflächen kontrastiert werden.

UP 9.24 Wed 18:30 Poster F

Investigating the tropical tropopause layer (TTL) using the NASA Global Hawk: First DOAS results from the ATTREX test mission in fall 2011 — •Bodo Werner[1], Klaus Pfeilsticker[1], Max Spolaor[2], and Jochen Stutz[2] — [1]IUP, University of Heidelberg — [2]University of California Los Angeles

The investigation of chemical and physical processes in the tropical tropopause layer (TTL) is challenging, in particular over the Pacific Ocean, as few airborne platforms are able to reach the required altitudes of 15-20km in this region. The Airborne Tropical TRopopause EXperiment (ATTREX) is a new NASA project that makes use of NASA's new Global Hawk UAV platform to study the chemistry and physics in the TTL. The IUP/UCLA collaboration developed a novel limb scanning 3 channel (UV/vis/near-IR) mini-DOAS (Differential Optical Absorption Spectroscopy) spectrometer to fly on NASA's Global Hawk. Major scientific foci of the mini-DOAS are to study the photochemistry and budget of ozone destroying radicals (e.g. NO2, BrO, CH2O, IO, OClO), the amount of atmospheric greenhouse constituents (e.g. gaseous H2O), and the abundance of liquid and solid water cloud particles and their optical properties and microphysics within the TTL.

Here we introduce the NASA ATTREX project and discuss the major features of the mini-DOAS instrument. We also present results from the first ATTREX mission in fall 2011, during which three 18 - 24 hours long flights from NASA's Dryden Flight Research Center in California into the eastern Pacific TTL were successfully performed.

UP 9.25 Wed 18:30 Poster F

Determination of Continuous Urban Trace Gas Distribution Maps such as NO_2, O_3 and SO_2 Using Tomographic LP-DOAS Measurements — •Denis Pöhler[1], Andreas Hartl[2], and Ulrich Platt[1] — [1]Instiute of Environmental Physics, University of Heidelberg — [2]School of Energy and Environment, City University of Hong Kong

Measurements of trace gases are nowadays performed in all larger cities for urban air pollution monitoring by applying few in-situ measurement stations which can not capture variations on scales of several 10 to 100m. Tomographic LP-DOAS measurements allow deriving two and three dimensional distributions of trace gases by measuring the average concentration along many intersecting light paths and applying tomographic inversion techniques. Results of the first application of this technique in the city of Heidelberg, Germany, are presented to derive the horizontal distribution of NO_2, SO_2, O_3, HCHO and HONO over an area of 4 * 4 km^2 with different emission sources.

We developed an optimised tomographic retrieval for such measurements by applying the algebraic reconstruction method SIRT (Simultaneous Iterative Reconstruction Technique). The retrieved time series had a temporal resolution of up to 15 minutes and spatial resolution of about 500m. Best results are achieved for the trace gases NO_2, SO_2 and O_3. The data are used to study the distributions of emission sources in the city, diurnal cycles of the local emission concentrations, chemical transformation processes, the distribution and transport of emission plumes and the influence from wind speed and direction.

UP 9.26 Wed 18:30 Poster F

Comparison of Tropospheric Ozone Columns as seen by SCIAMACHY using limb-nadir-matching with tropospheric Ozone Columns as seen from OMI/MLS — •Stefan Bötel, Annette Ladstätter-Weissenmayer, Felix Ebojie, Christian von Savigny, and John P. Burrows — Institute of Environmental Physics, Universität Bremen, Bremen, Germany

SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric ChartographY) launched in March 2002 measures sunlight,transmitted, reflected and scattered by the earth atmosphere or surface (240 nm - 2380 nm). SCIAMACHY measurements yield the amounts and distribution of O3, BrO, OClO, ClO, SO2, H2CO,

NO2, CO, CO2, CH4, H2O, N2O, p, T, aerosol, radiation, cloud cover and cloud top height in limb as well as nadir mode. With it*s collocated limb and nadir measurements limb-nadir-matching can be used to determine tropospheric ozone columns from SCIAMACHY limb and nadir measurements. Using OMI total columns and MLS stratospheric columns tropospheric ozone can be measured globally. Both instruments were launched in 2004 on Aura. A comparison of the global tropospheric ozone distribution from SCIAMACHY limb-nadir-matching with the distribution from OMI/MLS will be shown in study.

UP 9.27 Wed 18:30 Poster F

A mobile FTIR system for ground-based total-column measurements of greenhouse gases — •Sabrina Niebling[1], Marc Geibel[1,2], and Dietrich Feist[1] — [1]Max Planck Institute for Biogeochemistry, Jena, Germany — [2]now at: Department of Applied Environmental Research, Stockholm University, Sweden

Greenhouse gases like CO_2 and CH_4 can be measured very accurately by in-situ methods. Satellite instruments (e.g. SCIAMACHY) are less accurate but provide potentially global coverage. However, linking the near-surface in-situ measurements with the total-column satellite measurements is not straightforward. Ground-based Fourier Transform Infrared (FTIR) instruments, which measure greenhouse gas total columns very precisely, can provide this link and serve as a validation reference. The Atmospheric Remote Sensing Group of the MPI for Biogeochemistry has constructed a fully automated and mobile FTIR measurement system for CO_2, CH_4, N_2O and other trace gases. The reliability of the instrument was checked during a six-month campaign to Wollongong, Australia, in 2010, where it measured side-by-side with another FTIR instrument. The system will be installed on Ascension Island (7.94°S, 14.37°W) in February 2012. Up to now such ground-based FTIR measurements are very sparse in the Southern Hemisphere, especially in the very active tropical regions. When installed at its final destination, our instrument will be the first equatorial station within the Total Carbon Column Observing Network (TCCON). Due to its unique location we expect new insights into the carbon cycle especially of the African continent.

UP 9.28 Wed 18:30 Poster F

MAX-DOAS and CE-DOAS Measurements on RV Sonne during the SHIVA campaign — •Johannes Lampel[1], Martin Horbanski[1], Denis Pöhler[1], Enno Peters[2], Folkard Wittrock[2], Udo Friess[1], and Ulrich Platt[1] — [1]Institut für Umweltphysik, Universität Heidelberg — [2]Institut für Umweltphysik, Universität Bremen

During the SHIVA campaign (Stratospheric Ozone: Halogen Impacts in a Varying Atmosphere) on RV Sonne along the coast of Borneo in November 2011 two MAX-DOAS instruments from IUP Heidelberg and Bremen and additionally a CE-DOAS System to measure iodine monoxide mixing ratios were operated. First results from these instruments and a comparison, if applicable, will be shown. Reactive bromine and iodine compounds emitted from the ocean in the atmosphere can be of great importance for the chemical balance of the marine boundary layer, even if they are present, if at all, in very small amounts of only some parts per trillion. Furthermore they might be transported to the stratosphere due to convection. Their impact ranges from the destruction of ozone and the modification of the oxidative capacity to possible creation of cloud condensing nuclei.

UP 9.29 Wed 18:30 Poster F

Vergleich der Sichtweitenmesstechnik für den Offshore-Einsatz — •Jörg Bendfeld — Universität Paderborn, Paderborn, Deutschland

In der Meteorologie wird definitionsgemäß dann von Nebel gesprochen, wenn die horizontale Sichtweite auf unter 1000 m zurückgeht und keine anderen Wetterereignisse für diese Sichtreduzierung verantwortlich sind. Nebel besteht aus kleinsten Wassertröpfchen (etwa 10 bis 40μm im Durchmesser), die in der Luft schweben und dadurch den extrem starken Sichtrückgang verursachen. Durch die Größe der Tropfen wird das Licht stark gestreut. Sichtmesssysteme basieren im Wesentlichen auf dem Prinzip des Ausstrahlens eines Lichtstrahls auf den Messbereich und des Verarbeitens des empfangenen Lichtstrahls, um verschiedene Parameter, die die Sicht des Bereichs, der von dem Lichtstrahl durchlaufen wird, kennzeichnen, zu ermitteln. Gegenwärtig verwendete Messsysteme setzen zum Beispiel Transmissometer, Reflexionsmesser oder Streusensoren ein.

UP 9.30 Wed 18:30 Poster F

Analyse ausgewählter Nebelereignisse für Offshore-Standorte — •Jörg Bendfeld, Stefan Balluf und Benedikt Liebing — Universität Paderborn, Paderborn, Deutschland

Nebel ist definiert als Absinken der horizontalen Sichtweite auf unter 1000 m wenn keine anderen Wetterereignisse für diese Sichtreduzierung verantwortlich sind. Die Wettererscheinung Nebel wird hervorgerufen durch mikroskopisch kleine, in der Luft schwebende Wassertröpfchen.

Der genutzte Sichtweitensensor ist ein optischer Sensor zur Messung der Sichtweite (MOR). Er nutzt dazu das Prinzip der Vorwärtsstreuung. Hierbei wird Licht durch Partikel gestreut, deren Durchmesser in der Größenordnung der Wellenlänge von Licht liegen. Die Streuung ist zur Dämpfung proportional. Größere Partikel verhalten sich wie Reflektoren und Refraktoren, so dass ihr Einfluss auf die meteorologische Sichtweite separat zu behandeln ist. Der Sensor kann einzelne Tropfen durch schnelle Signaländerungen erkennen.

Die analysierten Nebenereignisse zeigen die Charakteristik der Nebelentstehung sowie den zeitlichen und räumlichen Verlauf der Sichtweitenminderung.

UP 9.31 Wed 18:30 Poster F

The Linear Mirror — Hans Grassmann[1], Giulia Pesaro[1], Elvis Kapllaj[1], •Dan Wargulski[2], and Barbara Sandow[2] — [1]Department of Physics, University of Udine, Via delle Scienze 208, I-33100 Udine — [2]Department of Physics, Free University Berlin, Arnimallee 14, D-14195 Berlin

At the time exist several quite different techniques for exploiting solar energy. One of this techniques exploit solar energy by means of concentrating mirror systems.We investigate a two-dimensional array of plane mirrors operated by two motors and a solar thermal collector, which collects efficiently sun light in order to produce heating water. This system preserves the merits of previous state-of-the-art solar power plants but is simpler and applicable in every one family house. The investigation of the linear mirror system are focused on temperature- and heat capacity profiles as a function of day-time and the solar altitude angle. First measurements will be discussed.

UP 10: Lecture by Michael Ghil on Climate Change

Time: Thursday 8:30–9:15 Location: H 0105

Plenary Talk UP 10.1 Thu 8:30 H 0105

The Complex Physics of Climate Change: Nonlinearity and Stochasticity — •Michael Ghil — Ecole Normale Supérieure, Paris, France — UCLA, Los Angeles, USA

Recent estimates of climate evolution over the coming century still differ by several degrees. This uncertainty motivates in part the work presented herein.

The complex physics of climate change arises from the large number of components of the climate system, as well as from the wealth of processes occurring in each of the components and across them. This complexity has given rise to countless attempts to model each component and process, as well as to two overarching approaches to apprehend the complexity as a whole: deterministically nonlinear and stochastically linear. Call them the Ed Lorenz and the Klaus Hasselmann approach, respectively, for short.

We propose a "grand unification" of these two approaches that relies on the theory of random dynamical systems. In particular, we apply this theory to the problem of climate sensitivity, and study the random attractors of nonlinear, stochastically perturbed systems, as well as the time-dependent invariant measures supported by these attractors.

Results are presented for several simple climate models, from the classical Lorenz convection model to El Nino-Southern Oscillation models. Their attractors support random Sinai-Ruelle-Bowen measures with nice physical properties. Applications to climate sensitivity and predictability are discussed.

This talk presents joint work with M. D. Chekroun, D. Kondrashov, J. C. McWilliams, J. D. Neelin, E. Simonnet, S. Wang, and I. Zaliapin.

UP 11: Methods 2

Time: Thursday 9:30–10:00 Location: HFT-FT 131

UP 11.1 Thu 9:30 HFT-FT 131

Inter-satellite laser interferometry for a GRACE follow-on mission — •Christoph Mahrdt, Benjamin Sheard, Daniel Schütze, Gunnar Stede, Vitali Müller, Oliver Gerberding, Marina Dehne, Nils Brause, Gerhard Heinzel, and Karsten Danzmann — Max-Planck Institut für Gravitationsphysik (Albert-Einstein-Institut), Hannover

The Gravity Recovery and Climate Experiment (GRACE) is the first mission to monitor mass changes within the Earth system on a global scale. Launched in 2002 GRACE produced measurements of Earth's time varying gravitational field with unprecedented accuracy, revealing mass changes in the Cryosphere and Hydrosphere. Continuation of the measurements after the expected end of orbit lifetime in 2015 is important to gain knowledge on long term trends and climate change. Therefor a GRACE follow-on mission is planned for 2016. The design will be a copy of the current GRACE mission with some minor improvements to reduce development costs and risk. A way to improve the estimates of the gravitational field in future missions is to use inter-satellite laser interferometry to increase the ranging precision. To test the new technology in space a laser interferometer demonstrator is planned to be placed additionally to the microwave instrument on board the two satellites. This talk will give an overview of the planned design and the current status of its development.

UP 11.2 Thu 9:45 HFT-FT 131

Complex networks from irregularly sampled time series of palaeo data — •Kira Rehfeld[1,2], Norbert Marwan[1], Sebastian Breitenbach[3], and Jürgen Kurths[1,2] — [1]Potsdam Institute for Climate Impact Research, Potsdam, Germany — [2]Department of Physics, Humboldt University Berlin, Berlin, Germany — [3]Department of Earth Sciences, Swiss Federal Institute of Science and Technology (ETH), Zürich, Switzerland

In order to understand regional climate changes in spatially extensive and complex regions, combined information from palaeo archives, such as stalagmites, tree rings and sediment records is necessary. To this end, complex networks present a powerful and increasingly popular tool for the description and analysis of interactions within complex spatially extended systems in the geosciences. Such a network is typically constructed by thresholding a similarity matrix which in turn is based on a set of time series representing the (Earth) system dynamics at different locations. Regarding the pre-instrumental past, information about the system's processes and thus its state is available only through the reconstructed time series which – most often – are irregularly sampled in time and space. Interpolation methods introduce strongly sampling-dependent additional errors, thus we use our recently developed methods to quantify linear (Pearson correlation) and non-linear (mutual information) similarity in presence of heterogeneous sampling. We illustrate our approach in the assessment of Holocene Asian monsoon dynamics from stalagmite records.

UP 12: Climate - Modelling, joint session with jDPG

Time: Thursday 10:00–12:30 Location: HFT-FT 131

Invited Talk UP 12.1 Thu 10:00 HFT-FT 131

The first Arctic ozone hole in spring 2011 - observations, current understanding and relation to climate change — •Markus Rex, Ingo Wohltmann, Peter von der Gathen, and Ralph Lehmann — Alfred-Wegener-Institut für Polar- und Meeresforschung

The Arctic winter 2010/2011 was characterized by an unusually stable and cold polar vortex in the lower stratosphere. Conditions for the formation of polar stratospheric clouds were widespread and the fraction of the polar vortex exposed to such conditions was the largest in the observational record, which started in the mid-1960s. The combination of extremely cold conditions throughout the winter with a long lived and stable vortex in spring led to record chemical destruction of ozone in the Arctic. Based on the measurements of the Match ozonesonde network and the Microwave Limb Sounder (MLS) instrument on Aura we will discuss the degree and the time evolution of this record loss and compare the Arctic ozone loss in 2011 with the range of ozone losses that occurred in early and recent Antarctic ozone holes. Model calculations of our fully lagrangian Chemical Transport Model ATLAS are used to assess our current theoretical understanding of the processes that lead to Arctic ozone loss and to highlight the role of denitrification for the record loss in 2010/2011. Analyses of the long term evolution of meteorological conditions in the lower polar stratosphere and approaches to diagnose climate change related changes in these from Climate Model output suggest a link between climate change and the occurrence of increasing degrees of Arctic ozone loss.

30 min coffee break

Invited Talk UP 12.2 Thu 11:00 HFT-FT 131

Potential tipping elements of the climate system — •Anders Levermann — Potsdam Institute for Climate Impact Research, Potsdam, Germany — Physics Institute of Potsdam University, Potsdam, Germany

Some regions and processes within the global climate system respond strongly non-linear to gradual changes in background climate with potentially dramatic impact on human society and nature. The talk discusses a number of these so-called tipping elements with respect to their underlying physical feedbacks: North Atlantic Current, Indian monsoon circulation and West Antarctic Ice Sheet. (Levermann et al. 2012, Climatic Change.)

UP 12.3 Thu 11:30 HFT-FT 131

Skaleninvariante Horizontaldiffusion in einem Globalen Zirkulationsmodell — •Urs Schaefer-Rolffs und Erich Becker — Leibniz-Institut für Atmosphärenphysik, D-18225 Kühlungsborn

Globale Zirkulationsmodelle (General Circulation Models, GCMs) sind für das Verständnis der Dynamik der globalen Zirkulation der Atmosphäre unentbehrlich. Grundlagen bilden die hydro- und thermodynamischen Gleichungen sowie die Wechselwirkungen der aufgelösten mit den nicht aufgelösten Skalen. So ist für die vollständige Beschreibung des Lorenzschen Energiezyklus die horizontale Energiekaskade in den subskaligen Bereich essentiell. Die dazu konventionell verwendete Hyperdiffusion ist jedoch nicht physikalisch konsistent.

Im *Kühlungborn Mechanistic general Circulation Model* verwenden wir seit 2007 das nichtlineare Smagorinsky-Schema basierend auf dem Mischungsweg-Konzept zur Parametrisierung der Horizontaldiffusion. Trotz einer erstmalig thermodynamisch korrekten Simulation des Energiezyklus zeigt das Smagorinsky-Schema Defizite. Um diese zu lösen, erweitern wir unser GCM mit dem Dynamischen Smagorinsky-Modell (DSM). Das DSM vermag die Mischungslänge lokal aus den kleinsten aufgelösten Skalen abzuschätzen.

In unserer Präsentation werden wir zunächst kurz auf die Theorie des DSM eingehen; nach unserem Kenntnisstand wurde das DSM bisher nicht in GCMs zur Parametrisierung der Horizontaldiffusion verwendet. Wir zeigen außerdem detailliert, welche Verbesserungen im Energiespektrum erreicht werden können.

UP 12.4 Thu 11:45 HFT-FT 131

Calculation of climate trend functions from local time series using a Monte-Carlo-enhanced process — •Dieter Ihrig — FH Südwestfalen, Iserlohn, Germany

Most of the scientific community accepts the fact that there is a temperature increase since pre-industrial time looking to the yearly mean temperature. But not overall the world the yearly mean temperature is clearly increasing. In Germany for example the yearly mean temperature is decreasing during the last 3 years. It is not really helpful to calculate a trend function as a straight line over few years. To understand the climate system and climate models it will be helpful to know the temperature trends in the sens of new time series depending on the locality or at least to latitude. A method to extract trends from time series using a Monte-Carlo-enhanced filtering process was

presented 2008 in Darmstadt. The performance of the method will be demonstrated using simulated climate trend functions. The method will be applied at real climate series (1881 to 2011) of 40 stations. The calculations are made for yearly mean temperature and 12 monthly mean temperature. The results in temperature trends are compared with respect to the latitude. Using the temperature trend the change of net radiation energy input is calculated and discussed with respect to the latitude.

Invited Talk UP 12.5 Thu 12:00 HFT-FT 131

How variable is our climate? — •Thomas Laepple[1] and Peter Huybers[2] — [1]Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany — [2]Harvard University, USA

Determining the magnitude of natural climate variability is neccessary for predicting the plausible range of future climates. While the instrumental record is too short to determine slow climate variations, the analysis of climate archives of the mid-late Holocene (7000yr BP to modern) provides information about variations on decadal to millenial timescales. In a systematic comparison of paleo-temperature records and general circulation model (GCM) simulations, we show that current models systematically underestimate the variance in regional ocean temperature variability during the mid-late Holocene, with the discrepancy increasing from decadal to millennial timescales to more than an order of magnitude. The possibility that the greater variability results from noise in temperature proxies is rejected after analysis of the covariability between instrumental temperature records and coral, alkenone, and Mg/Ca proxies of temperature. The balance of evidence indicates that internal climate variability is much larger than simulated by GCMs on decadal and longer timescales, though the sensitivity of the climate system and magnitude of external forcing could also be greater at multi-decadal and longer timescales than presently accounted for in GCMs. In either case, these results suggests that model simulations are biased toward showing a too stable climate.

UP 13: Poster session (continued from Thuesday evening)

Time: Thursday 12:30–13:30 Location: Poster F

Poster session continued from Wednesday evening

UP 14: Atmosphere 2

Time: Thursday 14:00–17:15 Location: HFT-FT 131

UP 14.1 Thu 14:00 HFT-FT 131

Cyclone induced East-Asian SO2 transport to the lower stratosphere: First proof by airborne measurements of SO2 and Fukushima Xe-133 — Hans Schlager[1], •Frank Arnold[2,1], Robert Baumann[1], Heinfried Aufmhoff[1], Anja Reiter[1], Hardy Simgen[2], Ludwig Rauch[2], Sebastian Lindemann[2], Florian Käther[2], and Ulrich Schumann[1] — [1]DLR, IPA , Oberpfaffenhofen, Germany — [2]MPIK, Heidelberg, Germany

The stratospheric aerosol layer contributes to the planetary albedo and influences stratospheric chemistry, and therefore is of considerable interest. The layer is thought to be formed preferably via SO2 injection by volcanic eruptions. Here, we report on observations of anthropogenic SO2 injection into the lower stratosphere. We have conducted airborne measurements of elevated SO2 and Fukushima Xe-133 at altitudes up to 13 km. The Xe-133, which was released by the March 2011 Fukushima nuclear power plant complex accident, is chemically inert and served as an ideal transport tracer. It has a half-live (against radioactive decay) of 5.25 days, similar to the SO2 half-live (against OH-induced conversion to aerosol particles). Our measurements unambiguously proved that cyclone induced injection of East-Asian SO2 containing planetary boundary layer air into the upper troposphere and lower stratosphere is operative. Implications of the observed injected stratospheric SO2 are discussed, including the formation and effects of stratospheric aerosol particles.

UP 14.2 Thu 14:15 HFT-FT 131

Entwicklung und Anwendung eines kompakten Langpfad-DOAS-Instruments basierend auf Faseroptik und LEDs — •Stefan Schmitt[1], Denis Pöhler[1], Sebastian Landwehr[1], Jens Tschritter[1], Holger Sihler[1,2] und Ulrich Platt[1] — [1]Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg, Deutschland — [2]Max Planck Institut für Chemie, Joh.-Joachim-Becher-Weg 27, 55128 Mainz, Deutschland

Langpfad-Differentielle Optische Absorptionsspektroskopie (LP-DOAS) ist eine etablierte Methode zur genauen Bestimmung von Spurengaskonzentrationen, z.B von NO_2, O_3, SO_2, HCHO, IO und BrO. Aufgrund des Gewichts von bis zu 100 kg und der komplexen Bedienung ist das Anwendungsfeld heutiger Instrumente beschränkt auf stationäre Messungen in Regionen mit ausreichender Infrastruktur.

Wir präsentieren ein neu entwickeltes, kompaktes LP-DOAS Instrument basierend auf Faser-Optik und LEDs. Geringes Gewicht, kompakte Bauform und niedriger Stromverbrauch ermöglichen es dem neuen Gerät, das Anwendungsgebiet von LP-DOAS Messungen auf entlegene Regionen, wie Küsten und Vulkane, zu erweitern.

Im Sommer 2011 konnten räumliche Verteilungen von Jodmonoxid (bis zu 36 ppt) an der Westküste Irlands mit dem neuen System aufgelöst werden. Die gemessene Konzentrationen korrelieren stark mit Sonneneinstrahlung und Tidenhöhe und unterstützen die Theorie, das küstennahen Makroalgen die Quelle für Jodemissionen sind.

UP 14.3 Thu 14:30 HFT-FT 131

Luftpaket-Verfolgung mit der fliegenden Atmosphären-Forschungsstation CARIBIC — •Armin Rauthe-Schöch[1], Angela Baker[1], Tanja Schuck[1], Carl Brenninkmeijer[1], Greta Stratmann[2] und Peter van Velthoven[3] — [1]Max-Planck-Institut für Chemie, Mainz — [2]Deutsches Zentrum für Luft- und Raumfahrt, Institutfür Physik der Atmosphäre, Wessling — [3]Koninklijk Nederlands Meteorologisch Instituut (KNMI), De Bilt, Niederlande

Das Forschungsprogramm CARIBIC (Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container) untersucht physikalische und chemische Prozesse in der Erdatmosphäre mit einem Mess-Container an Bord eines Lufthansa Langstrecken Airbus A340. Das dafür speziell konstruierte Einlass-System ist permanent am Flugzeug montiert und besitzt Einlässe für Luft, Wasserdampf und Aerosolpartikel. Neben in-situ Messungen werden Luftproben gesammelt zur späteren Untersuchung im Labor. Auch ein MAX-DOAS System und eine Videokamera zur Wolkenbeobachtung sind vorhanden. Seit 2005 wurden von Frankfurt aus auf mehr als 250 Passagierflügen in die ganze Welt Messungen durchgeführt. Nach den Flügen werden am KNMI Rückwärtstrajektorien berechnet, um die Quellen der gemessenen Luftpakete zu ermitteln. Auf den monatlich vier aufeinanderfolgenden Messflügen werden in einigen Fällen Luftpakete zweimal durchflogen. Der Vortrag diskutiert die Schwierigkeiten bei der Bestimmung von doppelt gemessenen Luftpaketen und präsentiert erste Ergebnisse der beobachteten Spurengas-Änderungen während des Transports der Luftpakete zwischen den beiden CARIBIC-Messungen.

UP 14.4 Thu 14:45 HFT-FT 131

Retrieval of atmospheric CO2 from satellite near-infrared nadir spectra — •M. Reuter, M. Buchwitz, O. Schneising, J. Heymann, H. Bovensmann, and J.P. Burrows — Institute of Environmental Physics, University of Bremen, Germany

Carbon dioxide is the most important anthropogenic greenhouse gas. Its global increasing concentration in the Earth*s atmosphere is the main driver for global warming. However, in spite of its importance, there are still large uncertainties on its global sources and sinks. Satellite measurements, if accurate and precise enough, have the potential to reduce these surface flux uncertainties. At present, there are only two satellite instruments orbiting the Earth which are able to measure the CO2 mixing ratio (XCO2) with large sensitivity also in the boundary layer. In 2002 SCIAMACHY aboard ENVISAT started the time series of XCO2 observation from space followed by GOSAT which

was launched in 2009. Recent XCO2 retrieval results of global SCIAMACHY nadir observations will be the focus of the presentation.

UP 14.5 Thu 15:00 HFT-FT 131

Automated identification and verification of long-range transport events of NO_2 in GOME-2 observations — •Achim Zien, Andreas Hilboll, Andreas Richter, and John P. Burrows — Institute of Environmental Physics, University of Bremen, Germany

Atmospheric long-range transport (LRT) events relocate trace gases from emission to downwind regions on an intercontinental scale, drastically altering the atmospheric chemistry in remote regions. Tropospheric NO_2 is a very short-lived, mainly anthropogenic trace gas with strong impact on the ozone chemistry. Emissions are very localized and allow identification of individual LRT events.

This phenomenon is investigated by remote sensing satellite observations which provide the spatial and temporal coverage needed to identify large-scale, multi-day events. The long, continuous time-series of such measurements allows the estimation of regional, seasonal and global statistics of such events.

Based on a non-cloud-filtered GOME-2 dataset of NO_2 slant columns, we use a special algorithm to identify LRT candidates and verify them using Lagrangian transport models. We further discuss the problems in the assessment of spatial extent and NO_2 content of LRTs, which are often associated with cloud formation.

As results of this study, we present statistics of NO_2 LRT events based on a 4-year dataset, showing that NO_2 LRT is not a rare phenomenon. We find strong seasonality in frequency and typical routes of such events. Based on simple estimations, we also provide statistics on the transported NO_2 mass.

30 min coffee break

Invited Talk UP 14.6 Thu 15:45 HFT-FT 131

Detection of gaseous sulphur and halogen species in the outgassing plume from volcano Mt. Etna — •Christiane Voigt[1,2], Philipp Jessberger[1,2], Dominik Schäuble[1], Tina Jurkat[1], Robert Baumann[1], Guiseppe Salerno[3], and Nicole Brobowski[4] — [1]DLR, Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany — [2]Johannes Gutenberg-Universität, Institut für Physik der Atmosphäre, Mainz, Germany — [3]Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Italy — [4]Ruprecht-Karls-Universität, Institut für Umweltphysik, Heidelberg, Germany

Volcanoes affect climate in multiple ways. Degassing volcanoes represent a strong local source of sulphur and halogen species into the troposphere, and the formation and deposition of acids may cause major environmental hazards.

Here we present new in-situ observations in the outgassing plume from the Sicilian volcano Mt. Etna. The volcanic plume was detected with two Atmospheric chemical Ionization Mass Spectrometers (AIMS) onboard the DLR research aircraft Falcon on 29 and 30 September 2011 during the CONCERT2011 campaign. High mixing ratios of SO2, HNO3 as well as chlorine and bromine species were measured in the ageing volcanic plume. In addition, SO2 and BrO fluxes were detected at the crater rim with different DOAS instruments. We link those observations using HYSPLIT trajectory calculations and investigate the complex chemical evolution of the Etna plume from its origin to about 12 hours plume age.

UP 14.7 Thu 16:15 HFT-FT 131

Stratospheric trends of ozone and bromine oxide from SCIAMACHY limb measurements — •Claus Gebhardt, Alexei Rozanov, Mark Weber, and John P. Burrows — University of Bremen, Institute of Environmental Physics

Anthropogenic sources of bromine pose a considerable risk to the stratospheric ozone layer. The exact contribution of bromine in the overall halogen related ozone loss is still uncertain. More than two decades after signing Montreal Protocol there are meanwhile indications for decreases in stratospheric bromine. The SCIAMACHY satellite instrument aboard ENVISAT now provides amongst others a decade of ozone and BrO profile measurements from the limb retrieval (2002-2011).

In this study we present vertically resolved trends for stratospheric ozone and BrO with a particular focus at their altitude and latitude variation. This is followed by comparisons of ozone trends with contemporary space borne instruments. An overview of the current bromine trends as derived from SCIAMACHY will be given.

UP 14.8 Thu 16:30 HFT-FT 131

Advances in CO_2 total column retrieval by mid-IR Fourier-Transform Spectroscopy — •Matthias Buschmann[1], Susanne Dohe[2], Emmanuel Mahieu[3], Nicholas Deutscher[1], Thorsten Warneke[1], and Justus Notholt[1] — [1]Institut für Umweltphysik, Universität Bremen — [2]Karlsruhe Institute of Technology (KIT) — [3]Université de Liège

Over the last decade ground-based remote sensing measurements of CO_2 have been established as an important component in the global observing system for greenhouse gases. Since 2004 the Total Carbon Column Observing Network (TCCON) sites have provided CO_2 retrievals in the near-IR region, which has several advantages. For example O_2 can be retrieved in the same spectral region and because the O_2 mole fraction is known, the CO_2 signal can be normalized by ratioing, thus systematic errors partly cancel. Additionally there is only one significant interference in the considered spectral window, namely water vapor, allowing analyzing broad spectral windows. CO_2 can also be retrieved in the mid-IR spectral region, but here many gases interfere and no O_2 absorptions are available. However there are 20 years of additional observations obtained in the mid-IR at a suite of FT-IR sites of the Network Detection of Atmospheric Composition Change (NDACC). It would be of great benefit to produce CO_2-data of sufficient precision from the mid-IR spectral region. In this study we have advanced the retrieval of CO_2 from the mid-IR spectral region. Limitations of the approach are outlined and the feasibility of a future CO_2-product of sufficient precision is discussed.

UP 14.9 Thu 16:45 HFT-FT 131

Ground based remote sensing of CO_2 and CH_4 using a mobile Bruker 120M FTIR spectrometer — •Christof Petri, Thorsten Warneke, Christine Weinzierl, and Justus Notholt — Institute of Environmental Physics, University of Bremen, Bremen, Germany

Throughout the last years the solar absorption spectrometry has been further developed to measure CO_2 and CH_4 with sufficient precision to contribute to the understanding of the cycle of these greenhouse gases. Such measurements are performed within the global "Total Carbon Column Observing Network" (TCCON), which was established in 2004. The observations within TCCON are performed in the near infrared spectral region using the high resolution Bruker 120 HR or 125 HR laboratory type interferometers. These instruments are quite large and expensive. For many applications mobile instruments would be required. However, up to now the required precision has not been demonstrated for mobile instruments. We performed observations using a mobile Bruker 120 M interferometer which is able to derive spectra with a resolution of 0.02 cm^{-1} as typically used in the TCCON network. The measurements have been performed in Bremen and compared to our observations using a Bruker 125 HR interferometer, which is part of the TCCON network. The observations have been performed for several months under different meteorological conditions. The retrieved results show that the instrument agrees within 0.2 % to the TCCON observations and that a precision of 0.3 % can be reached.

UP 14.10 Thu 17:00 HFT-FT 131

Rayleigh-Brillouin scattering of laser light in air - Results from laboratory and atmospheric measurements — •Benjamin Witschas[1], Oliver Reitebuch[1], Christian Lemmerz[1], Vieitez Maria Ofelia[2], Ubachs Wim[2], and van de Water Willem[3] — [1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany — [2]Laser Centre, Vrije Universiteit (VU), The Netherlands — [3]Physics Department Eindhoven, University of Technology, The Netherlands

The global observation of atmospheric wind profiles remains to be the highest priority need for weather forecast. Therefore, the European Space Agency ESA decided to implement the Atmospheric Dynamics Mission ADM-Aeolus to demonstrate the potential of the Doppler lidar technology for global wind profiling. Thereby, the laser of the Doppler lidar sends short pulses into the atmosphere where they are partly scattered by aerosols and molecules. The backscattered light is collected by a telescope and analyzed concerning its frequency. The frequency shift between emitted and received light, caused by the Doppler-effect, is directly proportional to the atmospheric wind speed. The accuracy of this measurement technique is significantly depending on the knowledge of the spectral distribution of the backscattered light. For the validation and the improvement of spectral line shape models of Rayleigh-Brillouin scattered light, laboratory measurements as well as

atmospheric measurements were performed. In my talk, the results of these measurements and the resulting influence on remote sensing techniques are extensively discussed.