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 chem-

ical 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 verschiede-

ner 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 atmosphere 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.