UP 4: Poster Session

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

UP 4.1 Tue 16:00 Foyer H41

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

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

UP 4.2 Tue 16:00 Foyer H41

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

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

UP 4.3 Tue 16:00 Foyer H41

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

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

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

UP 4.4 Tue 16:00 Foyer H41

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

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

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

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

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

UP 4.5 Tue 16:00 Foyer H41

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

While the first laboratory observation of the Raman effect took place almost 100 years ago, its implications in remote sensing applications, such as the Differential Optical Absorption Spectroscopy (DOAS) of scattered sunlight, still remain under investigation. The main contribution of inelastic scattering is due to rotational Raman scattering, it usually is observed as an additional intensity, leading to filling-in of solar Fraunhofer lines and absorption bands of atmospheric constituents. Measured optical densities are typically corrected for this effect, which is also known as Ring Effect. In contrast to that, Vibrational Raman scattering (VRS) of air was up to now thought to be negligible. We present (1) calculations of vibrational Raman cross-sections of O_2 and N_2 for passive DOAS measurements and show that consequences of VRS are red-shifted Fraunhofer Ghost Lines (FGL) in scattered light spectra and an additional filling-in of Fraunhofer lines. (2) Based on DOAS measurements during field campaigns, we present first unequivocal observations of FGL at optical densities of up to several 10^{-4}. From our measurements and calculations, we conclude that inclusion of this phenomenon in the spectral evaluation of weak absorbers will lead to considerably more sensitive and precise DOAS measurements.

UP 4.6 Tue 16:00 Foyer H41

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

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

UP 4.7 Tue 16:00 Foyer H41

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

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

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

UP 4.8 Tue 16:00 Foyer H41

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

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

UP 4.9 Tue 16:00 Foyer H41

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

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

UP 4.10 Tue 16:00 Foyer H41

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

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

UP 4.11 Tue 16:00 Foyer H41

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

Insbesondere in Küstenregionen unterliegt die Atmosphäre vielfältigen Einflüssen: Reaktive Halogenverbindungen vom offenen Ozean oder aus küstennahen Algen haben potentiell ebenso einen Einfluss auf die Chemie der Troposphäre wie anthropogene und biogene Emissionen vom Ozean sowie von Land. Um diese Einflüsse genauer spezifizieren zu können, finden seit Frühling 2015 an der englischen Südküste Messungen der Multi-AXis DOAS (MAX-DOAS) Methode statt, die die schräge Säulendichten und Vertikalverteilungen (in Bodennähe) verschiedener Spurengase ermitteln kann, darunter NO2, IO, BrO, HCHO und SO2. Gleichzeitig werden in-situ CO2, SO2, Methan und weitere Spurengase gemessen, sowie meteorologische Daten erhoben. Die vertikalen Konzentrationsprofile von Aerosolen und Spurengasen werden aus einer Kombination verschiedener Messwinkel und Strahlungstransportmodellen berechnet. Dazu wird ein Inversionsalgorithmus (HEIPRO) genutzt. Wir stellen Messungen der Vertikalprofile verschiedener Spurengase und deren Variation vor und beurteilen anhand von Wetter- sowie Schifffahrtsdaten den anthropogenen Beitrag zur Spurengaskonzentration in der Atmosphäre.

UP 4.12 Tue 16:00 Foyer H41

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

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

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

UP 4.13 Tue 16:00 Foyer H41

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

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

UP 4.14 Tue 16:00 Foyer H41

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

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

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

UP 4.15 Tue 16:00 Foyer H41

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

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