UP 15 Poster: Atmosphäre und Klima

Zeit: Dienstag 14:00–16:00 Raum: C

UP 15.1 Di 14:00 C

Ozone Depletion Events, in the Polar Boundary Layer in Spring: A Model Study — •Matthias Piot and Roland von Glasow — Institut fuer Umweltphysik 69120 Heidelberg

Reactive halogens play a major role in ozone depletion events (ODE). The reaction of bromine atoms with ozone, followed by the self-reaction of bromine oxides (BrO) represents a catalytic loss mechanism for ozone in the polar boundary layer (PBL). However, the triggering of the so-called "bromine explosion" remains unclear. We used the chemical and microphysical model MISTRA to study the mechanisms leading to these observed depletions in the boundary layer. We will present model results where we used prescribed bromine or chlorine fluxes as responsible for ODEs. Our sensitivity study consisted in a set of four-day runs where we changed initial mixing ratios or fluxes (or both) of 19 different species (including halogens, NOx, NOy, DMS, H2O2, HCHO...) and compared the results with base runs. Temperature and humidity has also been examined. We investigated the importance of these compounds for the chemistry of the PBL and focused on species which influence the occurrence of an ODE. In addition to the sensitivity study, we are now examining the role that frost flowers play in the bromine explosion, using MISTRA in the lagrangian 1D mode. The considered column passes over a field of frost flowers, followed by an area of open lead. We observed that all the bromide from sea salt aerosols is released to the gas phase. Our results indicate that aerosols from frost flowers are probably not directly responsible for the bromine explosion and that additional cycles have to been taken into account.

UP 15.2 Di 14:00 C

Retrieval of tropospheric NO_2 by synergistic use of ENVISAT/SCIAMACHY and ground-based solar FTIR measurements at the Zugspitze — •Ralf Sussmann[1], Wolfgang Stremme[1], Johan P. Burrows[2], Andreas Richter[2], Wolfgang Seiler[1], and Markus Rettinger[1] — [1]Forschungszentrum Karlsruhe, IMK-IFU, Garmisch-Partenkirchen — [2]Universität Bremen, Institut für Umweltphysik

Columnar NO_2 from FTIR measurements at the Zugspitze (47° N, 11° E, 2964 m asl.) was investigated synergistically with SCIAMACHY satellite data (Univ. Bremen algorithm UB1.5). A new concept to match FTIR data to the time of satellite overpass makes use of the NO_2 daytime increasing rate retrieved from the FTIR data set. SCIAMACHY data within a 200-km selection radius were considered, and a pollution-clearing scheme was developed to select only pixels corresponding to clean background tropospheric conditions. Analysis of the averaging kernels gives proof that at mountain-site FTIR is a highly accurate measure for the stratospheric column, while SCIAMACHY shows significant tropospheric sensitivity. Based on this finding, we set up a combined a posteriori FTIR-SCIAMACHY retrieval for free tropospheric NO_2. It yields an annual cycle with variations between 0.75-1.54E+15 cm^{-2} and an intermediate phase between that of the well known boundary layer and the stratospheric annual cycles. The outcome is a concept for an integrated global observing system for tropospheric NO_2 that comprises DOAS NADIR satellite measurements and a set of latitudinally distributed mountain-site or clean-air FTIR stations.

UP 15.3 Di 14:00 C

Modeling halogen chemistry in volcanic plumes — •Roland von Glasow[1], Nicole Bobrowski[1], and Alessandro Aiuppa[2] — [1]Institute of Environmental Physics, University of Heidelberg, Germany — [2]Dipartimento CFTA, Universita di Palermo, Italy

Bromine oxide has been measured in the plumes of several slowly erupting volcanoes. We compared field mesurements from Mt. Etna, Italy with results from a one-dimensional model that was initialized with volcanic plume compositions according to a thermodynamic model. Assuming an "effective source region"where plume air is being mixed with ambient air at still high temperatures we were able to reproduce the measuremnets for BrO and SO_2 very well. The model includes a parameterization for the horizontal entrainment of background air as well as a detailed set of gas-phase and aerosol-phase reactions. We will show a comparison with data and discuss the results and possible implications of this for the chemistry of the troposphere.

UP 15.4 Di 14:00 C

Ground-based solar absorption measurements of CH4 — •Thorsten Warneke[1], Justus Notholt[1], Voltaire Velazco[1], Katinka Peterson[1], and Otto Schrems[2] — [1]Institut für Umweltphysik, Universitaet Bremen — [2]Alfred Wegener Institut, Bremerhaven

Methane (CH4) is an important greenhouse gas in the atmosphere, which is addressed in the Kyoto-protocol. Since pre-industrial times its concentration has more than doubled. For the prediction of the future atmospheric concentration of methane a better understanding of the sources and sinks is needed. Information about atmospheric CH4 is mainly inferred from in situ measurements. The main limitation of these measurements is their sparse spatial distribution. Recently global atmospheric CH4 data retieved from the satellite instrument SCIAMACHY on ENVISAT became available. These data provides important information on methane sources and sinks. However, satellites measure the atmospheric CH4 column which is a different kind of information than the atmospheric CH4 in situ measurements. Especially due the strong decrease of CH4 in the stratosphere the in situ and satellite measurements are not directly comparable. In this work we link the satellite measurements to the in situ measurements by deriving tropospheric and total column concentrations of methane from ground-based solar absorption measurements at Ny Alesund (Spitsbergen, 79°N). The ground-based FTIR-data is compared with in-situ and SCIAMACHY satellite data.

UP 15.5 Di 14:00 C

Ground-based solar absorption measurements of CO - satellite validation and model comparison — •Voltaire Velazco[1], Justus Notholt[1], Thorsten Warneke[1], and Otto Schrems[2] — [1]Institut für Umweltphysik, Universitaet Bremen — [2]Alfred Wegener Institut, Bremerhaven

Ground-based solar absorption measurements using Fourier transform infrared (FTIR) spectrometers provide precise information about the concentration profiles of many atmospheric trace gases. Therefore these measurements play a vital role for the validation of current and future satellite instruments measuring atmospheric trace gases. Carbon Monoxide (CO) volume mixing ratio (VMR) profiles retrieved from ship borne solar absorption measurements recorded on the Atlantic have been compared with space borne measurements by the Measurements of Pollution in the Troposphere (MOPITT) instrument. The higher vertical resolution of the ground-based measurements allows to detect enhancements in the upper troposphere, which are not seen by MOPITT. The contributions of different sources such as biomass burning, fossil fuel combustion and oxidation of methane (CH4) and non-methane hydrocarbons (NMHC) have been quantified.

UP 15.6 Di 14:00 C

Ground-based solar absorption measurements of CO2 — •Ronald Macatangay[1], Justus Notholt[1], Thorsten Warneke[1], and Christoph Gerbig[2] — [1]Institut für Umweltphysik, Universitaet Bremen — [2]Max Planck Institut für Biogeochemie, Jena

Carbon dioxide is the most important anthropogenic greenhouse gas. Remote sensing measurements of CO2 from space are likely to become important constraints on carbon cycle processes in the near future. These measurements cannot be validated with in situ measurements, because the in situ measurements are of a single point and the satellites measure a weighted column integral. The measurement of solar absorption via ground-based Fourier transform interferometers (FTIR) can measure the same column integrals as the satellite but do so at a fixed point, making it amenable to direct comparison with aircraft or in situ observations. First results of solar absorption measurements performed during the Carboeurope Regional Experiment in France are presented.

UP 15.7 Di 14:00 C

Analysis of NO_x mixing ratios in the middle atmosphere determined by HALOE data — •Shahin Kazeminejad, Justus Notholt, John.P Burrows, Christian von Savigny, and Miriam Sinnhuber — Institut für Umweltphysik, Universität Bremen

The chemical composition of the middle atmosphere can be strongly influenced by Solar Proton Events (SPEs) and Energetic Electron Precipitation Events(EEPs). These events are well known sources of NO_x (N,

NO, NO_2) and HO_x (H, OH, HO_2), which both contribute to ozone loss in the middle atmosphere. Due to its long lifetime significant amounts of NO_x produced by large particle events in the mesosphere and the upper stratosphere can be transported down into the middle and lower stratosphere during polar winter, where NO_x is a key species in ozone loss. Thus large particle events can potentially contribute significantly to stratospheric ozone loss. This study uses NO_x measurements of the Halogen Occultation Experiment (HALOE) instrument onboard the UARS satellite covering the years 1991 - 2005, to investigate mesospheric NO_x production during more than one solar cycle.

UP 15.8 Di 14:00 C

Dated speleothems: archives of the paleoenvironment (DAPHNE) — •Augusto Mangini — Forschungsstelle Radiometrie, Heidelberger Akademie der Wissenschaften, Im Neuenheimer Feld 229, 69120 Heidelberg, Germany

In Summer 2005 the Deutsche Forschungsgemeinschaft approved funding for the Forschergruppe 668 (DAPHNE). In this interdisciplinary research group several researchers and scientists from Heidelberg, Bochum, Innsbruck and Trento collaborate to study speleothems over a period of six years. The intention of DAPHNE is to understand the basic mechanisms which control speleothem growth and composition by the combined application of field and laboratory experiments. In particular, the impact of kinetic fractionation processes on the oxygen isotope signal will be quantified. The knowledge of these basic mechanisms will allow for the first time to obtain high resolution information about the intensity of past precipitation and temperature from stalagmites. Hereby, speleothems will advance to a precisely dated continental archive providing quantitative climate information. By the application to Late Quaternary speleothems we will reconstruct the temporal and spatial variability of precipitation and temperature on a supra-regional scale. These data will represent an important basis for prognostic climate modeling. DAPHNE Members: A. Mangini, D. Scholz, A. Schröder-Ritzrau, C. Spötl, M. Isenbeck-Schroeter, D. Polag, D. K. Richter, S. Niggemann, S. Frisia, R. Miorandi, W. Aeschbach-Hertig, T. Kluge, B. Kromer, J. Fohlmeister

UP 15.9 Di 14:00 C

Network for Observation of Volcanic and Atmospheric Change (NOVAC) - Objectives and scientific chances. — •Christoph Kern[1], Nicole Bobrowski[1], Ulrich Platt[1], and Bo Galle[2] — [1]Institut für Umweltphysik, Universität Heidelberg, Im Neuenheimer Feld 229, 69120 Heidelberg, Germany — [2]Department of Radio and Space Science, Chalmers University of Technology, Horsalsvagen 11, S-412 96 Gothenburg, Sweden

The idea of the NOVAC project is to establish a global network of stations for the quantitative measurement of volcanic gas emissions by UV absorption spectroscopy making use of a novel type of instrument, the scanning dual-beam miniature Differential Optical Absorption Spectrometer (Mini-DOAS). Primarily, the instruments will be used to provide new parameters in the toolbox of volcanic observatories for risk assessment, gas emission estimates and geophysical research on the local scale. In addition to this, global estimates of volcanic gas emissions and their influence on climate change and stratospheric ozone depletion will be studied. In particular, large scale validation of satellite instruments for observing volcanic gas emissions will be possible for the first time.

Work on the NOVAC Project began in October, 2005. The presentation will include a description of the measurement techniques applied in the project, the scientific and technological objectives, and the contribution of the project towards the understanding of local and global atmospheric processes and climate change.

UP 15.10 Di 14:00 C

SCIAMACHY global cloud products — •Alexander Kokhanovsky, Vladimir Rozanov, Wolfgang Hoyningen-Huene, Marco Vountas, Wolfhardt Lotz, and John Burrows — Institute of Remote Sensing, University of Bremen, O. Hahn Allee 1, D-28334, Bremen, Germany

Global cloud top height spatial distribution as obtained using highly spectrally resolved SCIAMACHY on ENVISAT measurements in the oxygen A-band is presented. Also the global cloud phase index map is given. The results were derived using semi-analytical cloud retrieval algorithm developed by authors specifically for SCIAMACHY cloud retrievals. The algorithm is applicable for clouds having optical thickness larger than 5. Therefore, only thick cloud fields were selected for this study. We found that the global average cloud top height is close to 6km and the most frequent value of the phase index is close to 0.8.

UP 15.11 Di 14:00 C

The retrieval of oxygenated volatile organic compounds by remote sensing techniques — •Folkard Wittrock, Andreas Heckel, Hilke Oetjen, Andreas Richter, and John P. Burrows — Institute of Environmental Physics, University of Bremen, 28334 Bremen

This work describes global measurements of the trace gases formaldehyde and glyoxal derived from stray light spectra in the ultraviolet and visible wavelength region measured by the satellite instrument SCIAMACHY along with ground-based MAX-DOAS instruments. The analysis was carried out using the method of the Differential Optical Absorption Spectroscopy (DOAS). New algorithms to derive vertical columns of the satellite instruments are developed and described. For the ground-based geometry a way was found to derive profile information for the tropospheric absorbers.

A number of case studies illustrates the significance of biogenic emissions and of biomass burning for the global distribution of the oxygenated volatile organic compounds. A comparison with results from a global atmosphere model shows only a moderate agreement in many regions of the Earth. This reflects the limited state of knowledge at present about the very complex physical and chemical processes in the troposphere.

UP 15.12 Di 14:00 C

GOME and SCIAMACHY Measurements of tropospheric SO_2 — •Andreas Richter, Folkard Wittrock, and John P. Burrows — Insitute of Environmental Physics, University of Bremen, Otto-Hahn-Allee 1, D-28359 Bremen

Sulphur dioxide (SO_2) is an important atmospheric pollutant. It is emitted from volcanoes, both during degassing and through eruptions and also from anthropogenic activities such as coal burning, from refineries of oil and gas and nonferrous smelting. In the atmosphere, high concentrations of SO_2 not only adversely affect human health but also contribute to acid rain and the resulting damage to the ecosystem. In addition, SO_2 is closely linked to aerosol formation via sulphuric acid (H_2SO_4) with links to CCN formation, cloud droplet size and feedback mechanisms in climate forcing as well as heterogeneous chemistry.

In this study, one decade of SO_2 measurements from the two satellite instruments GOME (Global Ozone Monitoring Experiment) and SCIAMACHY (SCanning Imaging Absorption spectroMeter of Atmospheric CHartographY) is presented. The data is analysed for volcanic and anthropogenic emissions, and the spatial, seasonal and inter-annual variability is studied. One particular focus is on the potential to use different retrieval windows to obtain vertically resolved information.

UP 15.13 Di 14:00 C

Comparison of modelled and measured chlorine dioxide slant columns for the arctic winter 2004/2005 — •Hilke Oetjen, Thomas Medeke, Andreas Richter, Ninad Sheode, Björn-Martin Sinnhuber, Folkard Wittrock, and John P. Burrows — Institute of Environmental Physics, University of Bremen, 28334 Bremen

One of the important issues in atmospheric science is the stratospheric ozone depletion especially in polar regions. The most important halogen radicals involved in the ozone destruction are BrO and ClO. Whereas BrO can easily be detected by UV/visible spectroscopy this is not the case for ClO. But observations of chlorine dioxide (OClO) give a good indicator for chlorine activation in the polar vortex since the concentration of OClO is approximately proportional to the product of the concentrations of BrO and ClO during dawn and dusk.

This study presents ground-based and satellite, i.e. SCIAMACHY, measurements of chlorine dioxide by means of UV/visible spectroscopy over the Arctic for the exceptional winter 2004/2005. This winter was characterised by almost complete chlorine activation. The measurements will be compared to model calculations.