

UP 1: Atmosphäre und Klima

Zeit: Dienstag 8:30–11:45

Raum: 3B

UP 1.1 Di 8:30 3B

First atmospheric observations of C2F3Cl and C3F5Cl by means of GC/ECD/MS — ●JOHANNES LAUBE, ANJA WERNER, and ANDREAS ENGEL — Institut für Atmosphäre und Umwelt, Universität Frankfurt, Frankfurt (Main), Deutschland

We report the first atmospheric observations of the Chlorofluorocarbons (CFCs) Trifluorochloroethene and 3-Chloropentafluoropropene in air samples taken at the Taunus Observatory near Frankfurt (Main). Both substances belong to a class of CFCs containing a double bond and are connected to the preparation and thermal degradation of Polychlorotrifluoroethene (PCTFE), a widely used Fluoropolymer. Their atmospheric lifetimes are expected to be rather short. To analyse the air samples trace gases were pre-concentrated cryogenically, separated by Gas Chromatography and identified using an Electron Capture detector and a quadrupole Mass Spectrometer run in electron impact mode. A quantitative calibration is not available for these species, yet. The first identification was possible because of an air sample which showed high concentrations of these substances. We suggest that the very high abundances found on this occasion originated from a local source. However, we also observed the novel CFCs in air masses representing back ground conditions, though with much lower concentrations. These species are toxic and could also contribute to stratospheric chlorine which is relevant for ozone depletion. Therefore it is important to find out more about their sources and distribution in the atmosphere.

UP 1.2 Di 8:45 3B

SCIAMACHY, SABER und der solare 27-Tage Zyklus in stratosphärischen Ozonprofilen — ●SEBASTIAN DIKTY, MARK WEBER, JOSEPH A. PAGARAN and JOHN P. BURROWS — Institut für Umweltphysik der Universität Bremen

Die Sonne beeinflusst den Wärmehaushalt, die Dynamik und die Chemie der mittleren Erdatmosphäre. Solare UV-Strahlung wird zu einem erheblichen Teil von stratosphärischem Ozon absorbiert. Wenn sich nun die solare UV-Strahlung verändert, so ändert dies auch das stratosphärische und mesosphärische Ozon und andere Spurengase, die durch Photolyse gebildet werden (direkter Strahlungseffekt). Zudem spielt die dynamische Rückkopplung der mittleren Atmosphäre auf solare Variabilität eine Rolle (indirekter Strahlungseffekt). Im Besonderen ist der Einfluss von UV-Strahlung oberhalb von 60 km nicht hinreichend bekannt. Wir führen eine Fourieranalyse an Zeitreihen von höhenaufgelösten (ca. 30 bis 70 km) SCIAMACHY und SABER Limb-Daten durch, um ein solares Signal des 27-tägigen Sonnenrotationszyklus zu entdecken. Hieraus wird die Stärke der Ozonempfindlichkeit in Bezug auf UV-Strahlung abgeschätzt. SCIAMACHY (Scanning Imaging Absorption Spectrometer for Atmospheric Cartography) an Bord von ENVISAT und SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) an Bord des TIMED Satelliten wurden 2002 und 2001 gestartet. Als Referenz für die UV-Strahlungsvariabilität nutzen wir den SCIAMACHY Mg II Index. Die Ergebnisse dieser Studie werden in Hinblick auf frühere Ergebnisse diskutiert.

UP 1.3 Di 9:00 3B

MAX-DOAS measurements of bromine monoxide during Polarstern cruise ANTXXIII-7 — ●HENNING KIRK, ANDREAS RICHTER, ANJA SCHÖNHARDT, FOLKARD WITTRÖCK, and JOHN P. BURROWS — Institut für Umweltphysik, Universität Bremen

During springtime, a strong increase of *BrO*-concentrations in the polar boundary layer, so called bromine explosions, are observed, mainly by satellite instruments, e.g. SCIAMACHY. Those events are correlated with two further phenomena: The depletion of O_3 (ODE) and of *Hg* (AMDE) in the boundary layer. The AMDEs are on suspicion to be the main reason for the enhancement of *Hg* in the polar ecosystems.

Until now, neither the release mechanism of the *BrO* is understood in detail, nor is the exact source of the *Br*. Due to their high concentration in sea salt, the surfaces of frost flowers or aerosols originating from their erosion, are candidates to be the source of the *Br*.

We will present results of continuous ship borne MAX-DOAS measurements taken in the Weddell Sea during the Polarstern cruise ANTXXIII-7, from Aug. 24 - Oct. 29 2006. The main aim of our measurements was to identify specific bromine releasing areas. Simultane-

ously, the involved chemical components were measured as well as the surrounding conditions. Several bromine events have been observed, albeit at much lower levels than expected. A good correlation was found with the coincident O_3 and *Hg* measurements. Besides a case study of a moderate event, *BrO* time series, their relations to the relevant parameters, e.g. weather conditions, and their interpretation as effect of transport or local chemistry will be shown.

UP 1.4 Di 9:15 3B

Does the Brewer-Dobson Circulation change? - Three Decades of Mean Age of Air Derived from Stratospheric SF₆ Measurements — ●T. MÖBIUS¹, A. ENGEL¹, H. BÖNISCH¹, E. ATLAS², S. SCHAUFFLER³, R. BORCHERS⁴, I. LEVIN⁵, and U. SCHMIDT¹ — ¹IAU Uni Frankfurt — ²RSMAS/MAC University of Miami — ³NCAR Boulder — ⁴MPI für Aeronomie — ⁵IUP Uni Heidelberg

Changes in the atmospheric greenhouse gas loading are known to lead to an increase of the radiative forcing of the atmosphere. Model studies, as referenced in the WMO O_3 Assessment Report 2006, predict that this increase leads to a change in the behaviour of the overturning meridional circulation of the middle atmosphere, the Brewer-Dobson Circulation. The stratospheric mean age of air is a measure of the strength of this circulation. It can be derived from measurements of long-lived tracer, e.g. SF_6 . We present vertical profiles of SF_6 , measured in stratospheric whole-air samples. By reanalyses of stratospheric balloon samples a high quality data set of SF_6 in-situ measurements, spanning three decades, was obtained on a consistent calibration scale. The SF_6 data set was used to calculate the mean age of air of the stratosphere. The derived age of air trends show no decrease in contrast to the model predictions, but rather suggest a weak increase. To minimise the uncertainty we use fitting algorithms for the vertical age of air profiles and derive the mean age for specific altitude intervals. We studied the sensitivity of the derived trend by varying the input data set, to take into account the limited number of in-situ measurements and their seasonal and spatial distribution.

UP 1.5 Di 9:30 3B

What controls the inter-annual variability of Arctic ozone? — ●GREGOR KIESEWETTER and BJÖRN-MARTIN SINNHUBER — Institut für Umweltphysik, Universität Bremen

Understanding the processes that control the inter-annual variability of Arctic ozone during winter and spring is important to predict how the ozone layer will evolve in the coming decades. It is now well accepted that high latitude total ozone during spring is largely controlled by the flux of planetary-scale waves into the stratosphere during mid-winter, as measured by the Eliassen-Palm (EP) flux. E.g., years with low wave activity during mid-winter exhibit reduced poleward and downward ozone transport, enhanced confinement of air masses at high latitudes and low temperatures that favour chemical ozone destruction. Recently we found an unexpected correlation between high latitude ozone in March and high latitude ozone in the mid-stratosphere during the previous autumn. This observation raises the question of what controls the inter-annual variability of meteorological conditions and ozone in the Arctic stratosphere during spring. In order to investigate the mechanisms of this correlation, we are currently performing an assimilation of long-term satellite ozone data into a chemical transport model, which offers a perspective of studying the underlying processes in greater detail.

UP 1.6 Di 9:45 3B

Detection of climate trends from local time series using a Monte-Carlo-enhanced filtering process — ●DIETER F. IHRIG — FH Suedwestfalen, Iserlohn, Germany

Forced by the newest IPCC report last spring the discussion about climatic change became very hot. It is an extensive agreement 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. (And there are local monthly mean temperature time series showing a decreasing trend.) To understand the climate system and climate models it will be helpful to know the temperature trend depending on the locality or at least to latitude. Problems of filtering processes will be shown. A method to extract trends from time series (as new time series not as fitted functions)

using a Monte-Carlo-enhanced filtering process was presented 2006 in Heidelberg. The performance of the method will be demonstrated using simulated climate trend functions. The method will be applied at real climate series (1881 to 2006) of 38 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.

UP 1.7 Di 10:00 3B

Long-term scenarios for road transport's greenhouse gas emissions — HEIKE STELLER and ●JENS BORKEN — Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) in der Helmholtz-Gemeinschaft, Verkehrsstudien, Rutherfordstr. 2, 12489 Berlin

Scenarios for road transport's emissions have been developed as a consistent interpretation of the four IPCC-SRES marker scenarios for the first time. Emissions of CO₂, CH₄, NMHC, CO, NO_x, SO₂, PM, BC and OC are calculated for 2025, 2050 and 2100. Our bottom-up approach is differentiated by vehicle categories and fuel types for passenger and freight transport each. Thus, we present here most comprehensive road transport's data for the whole globe, by world region and by country with a grid resolution of 1° longitude by 1° latitude.

In all scenarios global road transport's CO₂ emissions continue to increase up to 2050 while global emissions of other substances decrease latest from 2020 on. Strong transport and emission growth occurs in all developing regions while OECD regions may stabilize or decrease their emissions from high levels. The range between scenarios indicates considerable impact of economic and demand growth as well as technical measures. For instance in Western Europe, CO₂ emissions may decrease by as little as 70 Mt or as much as 350 Mt from 2000 to 2050. In the same period CO₂ emissions in South Asia increase at least by 200 Mt and maybe as much as 1000 Mt.

UP 1.8 Di 10:15 3B

Are IPCC SRES emission scenarios outdated? A recalculation for the road transport sector — ●JENS BORKEN¹ and GRIET DE CEUSTER² — ¹DLR - Verkehrsstudien, Berlin — ²TML Leuven/Belgium

Contribution has been withdrawn.

30 min. break

UP 1.9 Di 11:00 3B

Latitudinal and vertical distribution of ethane retrieved from ground-based solar absorption measurements — ●ANNA KATINKA PETERSEN¹, THORSTEN WARNEKE¹, JUSTUS NOTHOLT¹, and OTTO SCHREMS² — ¹Institut für Umweltphysik (IUP), Universität Bremen, Bremen — ²Alfred Wegener Institut (AWI), Bremerhaven

Measurements of the global variations of trace gases are important for the understanding of chemical and dynamical processes that control the distribution of these trace gases. Emissions within the tropics, especially from biomass burning, contribute substantially to the global budgets of many important trace gases. Currently large uncertainties in the budgets of many trace gases in the tropics exist, mainly due to a lack of measurements. Fourier Transform Infrared (FTIR) spectroscopy has been found to be one of the most suitable instruments for

the measurements of atmospheric trace gases

We performed solar absorption FTIR measurements onboard the German research vessel Polarstern during five cruises on the Atlantic between 1996 and 2005 and at the tropical site Paramaribo, Suriname (5.8°N, 55.2°W) between September 2004 and November 2006. Here we present volume mixing ratio profiles of ethane (C₂H₆) and compare our results with space-borne data from the ATMOS instrument and with measurements from balloon sondes. The combination of the FTIR-observations with space-borne measurements is used to study the long-range transport of pollutants from the tropics to mid- and high latitudes.

UP 1.10 Di 11:15 3B

A Seasonal Cycle of Stratospheric Water Vapour above Mérida, Venezuela — ●SVEN H W GOLCHERT¹, MATHIAS PALM¹, CHRISTOPH HOFFMANN¹, PEDRO HOFFMANN², GERD HOCHSCHILD³, and JUSTUS NOTHOLT¹ — ¹Institut für Umweltphysik, Universität Bremen, Germany — ²Facultad de Ciencias, Universidad de Los Andes, Mérida, Venezuela — ³Institut für Meteorologie und Klimaforschung, Universität und Forschungszentrum Karlsruhe, Germany

The authors report on the first ground-based microwave radiometer being permanently operated in the tropics for the detection of middle-atmospheric water vapour distribution. The 22 GHz receiver WaRAM2 is continuously recording data above Mérida, Venezuela, since December 2006. It is set up at Mérida Atmospheric Research Station on top Pico Espejo (8°N, 72°W, 4760 m).

Water vapour plays a key role in atmospheric processes, both chemical and dynamical. It exhibits strong radiative activity, owing to its large infrared resonance, and forms a source gas for the highly reactive OH radical. It also substantially contributes to atmospheric heat transfer. Yet the processes governing water vapour distribution, variability, and trends are still not sufficiently understood. Mitigating these uncertainties presents a pressing issue for future climate modelling. The presentation demonstrates the suitability of WaRAM2 measurements for such an effort. An overview is given of the instrument performance and the retrieval of geophysical parameters from the data. Cross comparisons with other data round off the discussion.

UP 1.11 Di 11:30 3B

Optimized regularization for retrieval of partial column profiles from ground-based solar FTIR spectrometry — ●TOBIAS BORSBORFF and RALF SUSSMANN — Research Center Karlsruhe, IMK-IFU, Kreuzteckbahnstr. 19, 82467 Garmisch-Partenkirchen, Germany

The retrieval of vertical profiles from ground based solar infrared spectra is an ill posed problem and regularization is the major tool to stabilize the solution. Whenever a suitable climatology is missing the optimal estimation approach is not applicable and soft constraints like the Tikhonov regularization are used. An example CO profile retrieval of solar infrared FT spectra is used to show that a sub-optimal regularization can already lead to a significant loss of vertical information. The relation between the chosen retrieval grid, the regularization matrix and the unit of the state vector is discussed in detail. The altitude resolved smoothing error and the vertical resolution due to different Tikhonov regularizations is examined. Finally it is discussed what kind of vertical information can be extracted from the derived retrieval results.