UP 2: Atmosphäre II

Zeit: Dienstag 14:00–16:06 Raum: VMP 9 HS

Hauptvortrag UP 2.1 Di 14:00 VMP 9 HS

Climate Change: Why the Details Remain Cloudy — •Bjorn Stevens — Max-Panck-Institute für Meteorologie, Hamburg, Germany

The role of clouds in the climate system, and in climate change is reviewed. Not only do clouds remain the largest source of uncertainty in predictions of future climate change, their representation is also central to the behavior of other aspects of the system, ranging from aerosol-chemistry-climate interactions, to atmosphere-ocean interactions, to interactions with the terrestrial biosphere. The cloud problem, like cancer, is not one, but rather many problems, and thus involves many questions: a couple of which (warm-rain formation and the proclivity for non-linear mixing) are extracted and focused on in more detail in the second half of my presentation.

UP 2.2 Di 14:30 VMP 9 HS

Charakterisierung von auf Oberflächen deponierten Nanopartikeln durch Röntgenfluoreszenzanalyse unter streifendem Einfall — •Falk Reinhardt[1], Burkhard Beckhoff[1], Harald Bresch[2] und Stefan Seeger[2] — [1]Physikalisch-Technische Bundesanstalt, Abbestr. 2-12, 10587 Berlin — [2]Bundesanstalt für Materialforschung und -prüfung, Unter den Eichen 87, IV.24, 12205 Berlin

Röntgenfluoreszenzanalyse unter streifendem Einfall (Grazing Incidence X-Ray Fluorescence GIXRF) hat das Potential, effektiv zur Charakterisierung von auf Oberflächen deponierten Nanopartikeln beizutragen. Als Erweiterung der Totalreflexions-Röntgenfluoreszenzanalyse (TRFA) mit Synchrotronstrahlung, die sich durch die geringen Nachweisgrenzen auszeichnet, wird bei GIXRF der Einfallswinkel der anregenden Strahlung zwischen 0° und dem dreifachen des Totalreflexionswinkels variiert, um so das sich durch Reflexion am Substrat ausbildende stehende Wellenfeld beeinflussen zu können. Aus der Änderung der Röntgenfluoreszenzintensität der auf einer ebenen Oberfläche deponierten Partikel bei sich änderndem Wellenfeld lassen sich zusätzlich zu den Informationen über den Elementgehalt auch Aussagen über die deponierten Größenfraktionen treffen.

Mit einem differential mobility analyzer (DMA) wurden NaCl-Partikel und Zink-Verbindungen mit Größenklassen hinunter bis zu 10 nm auf Si-Wafern deponiert und mit GIXRF untersucht. Diese Partikel dienen als Modellsysteme für die quantitative Analyse von größenfraktionierten Aerosolen.

UP 2.3 Di 14:42 VMP 9 HS

Kohlenmonoxid (CO) Gesamtsäulen Messungen mit Kohlenmonoxid (CO) Gesamtsäulen Messungen mit bodengestützter solar und lunar FTIR-Absorptions-Spektroskopie in Mexiko Stadt — •wolfgang stremme[1], Ivan Ortega-Martinez[1], Roland Harig[2] und Michel Grutter[1] — [1]Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México, Mexico City — [2]Institut für Meßtechnik TU Hamburg-Harburg

Seit Oktober 2007 wird die Kohlenmonoxid (CO) Gesamtsäule mit bodengestützter solar und lunar FTIR-Absorptions-Spektroskopie in Mexiko (19,33°N, 99.18°W) gemessen. Die Spektren mit einer Auflösung von 0.5cm-1 werden mit dem scannenden Infrarot- System aufgenommen (SIGIS), das in gleicher Weise zur Sonnen- als auch Mondverfolgung genutz wird. Die CO-Säule wird mit dem Retrievalcode SFIT2 rekonstruiert. Die Zeitserie der vertikalen CO-Säule hat typischerweise einen anderen Tagesverlauf als die bodennahe CO-Konzentration. Deshalb ermöglicht eine Zeitserie von CO-Säulen in einer Mega-City verbesserte Satelliten-Validationen von CO- Hot-Spots. In dieser Arbeit wird eine effektive Höhe der bodennahen Grenzschicht aus CO Säule und bodennaher Konzentration rekonstruiert. Bei der Hinzunahme der Information über den horizontalen CO-Fluss (Wind und insitu CO Messungen der PEMBU und RAMA Netzwerke) kann die CO-Emission geschätzt werden. Messungen der CO-Säule in Mega-Citys liefern neue Informationen über anthropogene Emissionen auf regionaler Ebene und helfen zu verstehen, wie sich die globalen Emissionen aus regionalen Beiträgen zusammensetzen.

UP 2.4 Di 14:54 VMP 9 HS

First measurements of stratomesospheric CO at mid-latitudes derived from ground-based FTIR measurements at Zugspitze and Garmisch — •Tobias Borsdorff, Markus Rettinger, and Ralf Sussmann — IMK-IFU, Research Center Karlsruhe

Measurements of stratomesospheric CO at mid-latitudes are essential to understand transport processes in the middle atmosphere. Due to the strong latitudinal gradient of stratomesospheric CO, large scale planetary wave activity during winter and spring can displace CO enriched polar air meridionally over large distances. Model calculations suggest that even mid-latitude regions exhibit enhanced abundances of CO in winter/spring. However previous mid-latitude FTIR measurements did not find any significant seasonal cycle. Therefore an optimized retrieval for mid-latitudes is presented, and the stratomesospheric CO partial column from 24 - 100 km is derived from FTIR measurements at Zugspitze for the time period 1999 to 2008. The derived time series show a pronounced annual cycle which is comparable to findings from the WACCM model on the monthly mean basis. In addition, on the daily scale, our measurements reveal many events of enhanced CO between November and March with levels comparable to inner-vortex conditions. Finally, by analysis of Garmisch FTIR data (744 m a.s.l.) we confirm that our new successful retrieval of mid-latitude mesospheric CO is not restricted to high mountain stations and thus applicable to all mid-latitude stations.

UP 2.5 Di 15:06 VMP 9 HS

A lightweight, high-sensitivity PTR mass-spectrometer for measuring organic compounds on aircraft platforms — •Joel Brito, Detlev Sprung, and Andreas Zahn — Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology

As of May 2005 our institute deploys a modified Proton-Transfer-Reaction mass spectrometer (PTRMS) from IONICON onboard the passenger aircraft CARIBIC. Once per months for four consecutive long-distance flights from Frankfurt (Germany) to North/South America, Southern India or the Philippines the PTRMS measures acetone, acetonitrile, methanol, and acetaldehyde at 9-12 km altitude, which in the meantime led to the largest available dataset of these compounds in this altitude range.

The broad experience collected during the CARIBIC flights and with a custom-made PTRMS for laboratory use allowed us to develop a new airborne instrument where all components are optimized in terms of weight, size and function for the deployment onboard aircraft.

For the new German research aircraft HALO (High-Altitude and Long-range Aircraft, Gulfstream GV-550), an extremely lightweight, high-sensitivity, quadrupole PTRMS was developed. The total weight including zero-air generator and calibration system is ˜50 kg (without aircraft rack). The instrument is completely automated and via a sophisticated heating concept allows rapid high-sensitivity measurements shortly after aircraft launch. The first deployment is envisaged for the campaign *Oxidation Mechanism Observations (OMO)* in August 2009.

UP 2.6 Di 15:18 VMP 9 HS

Retrieval of atmospheric CO2 from satellite near-infrared nadir spectra in a scattering atmosphere — •Maximilian Reuter, Michael Buchwitz, Oliver Schneising, Heinrich Bovensmann, and John P. Burrows — Institute of Environmental Physics (IUP), University of Bremen, Germany

Atmospheric CO2 is the dominant anthropogenic greenhouse gas. Satellite measurements of the CO2 mixing ratio (XCO2) derived from the SCIAMACHY instrument aboard ENVISAT can provide valuable information to quantify regional CO2 sources and sinks. XCO2 can be derived by simultaneously retrieving the atmospheric column of CO2 and O2. Therefore, simulated sun normalized radiance spectra within the O2-A absorption band at around 760nm and of the CO2 band at 1580nm can be fitted to SCIAMACHY measurements. Unfortunately, both bands have a relatively large spectral distance and show also large differences of the strength of absorption. For this reason, path length modifications due to scattering by aerosols and clouds in both bands are also not identical, resulting in possible retrieval errors of XCO2. Sub-visible cirrus clouds with an optical depth of 0.03 can already significantly affect the retrieval. SCIAMACHY measurements within the CO2 band do not hold enough information to correct for this effect. However, valuable information about cirrus clouds can potentially be obtained from SCIAMACHY measurements in the O2-A band. We will present an optimal estimation based retrieval that accounts for cirrus

clouds by transferring cirrus information obtained from the O2-A band to the CO2 band.

UP 2.7 Di 15:30 VMP 9 HS

Using GOME, SCIAMACHY and Sonde Data to Retrieve Tropospheric Ozon Over the Tropics — •Annette Ladstätter-Weissenmayer, Stefan Bötel, Christian v. Savigny, and John P. Burrows — Institute of Environmenetal Physics, Otto-Hahn Allee 1, 28359 Bremen

The Global Ozone Monitoring Experiment (GOME) launched in April 1995 measures the sunlight back scattered by the surface in nadir viewing mode (240-790 nm) to detect O3, NO2, BrO, OClO, HCHO and SO2. 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. In this study data for the time period of 1998-2008 is used for the determination of tropospheric O3. Comparisons of the results of the retrieval of tropospheric O3 using satellite based data and sonde profiles will be shown for the tropical region. The main focus will be the comparisons of the results of two retrieval methods: Limb-Nadir-Matching and the Reference Sector Method. The validation will be carried out with the use of sonde data.

UP 2.8 Di 15:42 VMP 9 HS

Bromine chemistry in volcanic plumes — •Leif Vogel, Christoph Kern, Matthias Fickel, Markus Woehrbach, and Ulrich Platt — Institut für Umweltphysik, Uni Heidelberg

Optical remote sensing via scattered sunlight Differential Optical Absorption Spectroscopy (DOAS) has become a standard tool in volcanology to determine trace gases in volcanic plumes. Bromine monoxide (BrO) and sulphur dioxide (SO_2) were simultaneously measured at three different distances (4km, 10km, 16km) from the crater by ground based Multiaxis DOAS in the volcanic plume of Mt. Etna, Italy in July 2008. These distances correspond to plume ages of 3min, 7min, and 11min. Additional measurements of SO_2 fluxes were performed by a novel type of SO_2 UV-Camera as well as conventional road traverses also applying the DOAS technique. A SO_2 flux up to 10000 Mg/d was determined, which is elevated due to Mt. Etna's state of unrest during that period. For the MaxDOAS measurements, an improved evaluation scheme is proposed, which applies a variable fit range in order to minimize radiative transfer effects. Measured ratios are in the order of $BrO/SO_2 = 10^{-4}$. They are slightly lower than previously reported ratios, which might be explained by the new evaluation scheme. The change of ratio over time due to chemical reactions (e.g. "bromine explosion") is in the range of model calculations, although an unexplained minimum is observed in the ratio at 6.6 minutes plume age.

UP 2.9 Di 15:54 VMP 9 HS

An ICOS laser spectrometer for the measurement of CH_4 and CO_2 onboard a passenger aircraft (project CARIBIC) — •Lisa Kattner, Christoph Dyroff, and Andreas Zahn — Institut für Meteorologie und Klimaforschung, Karlsruhe Institute of Technology (KIT)

The flying laboratory CARIBIC (Civil Aircraft for Regular Investigation of the Atmosphere Based on an Instrument Container) has now successfully been running for more than 10 years, and is in its second stage of application onboard a Lufthansa Airbus A340-600. It has already delivered a vast and valuable variety of data concerning atmospheric gases and aerosol particles. Here we present a new system that measures methane (CH_4) and carbon dioxide (CO_2) by using off-axis integrated cavity output spectroscopy (ICOS). It is currently reconstructed to fulfil aircraft requirements. Measurement principles as well as instrument design and performance are described. Measurements of methane concentrations will be of special interest concerning the actual flight route of the CARIBIC passenger aircraft to Chennai (formerly Madras), southern India, which crosses one of the world's most extensive rice producing areas and thus, largest emitter of the third most important greenhouse gas.