UP 10: Atmosphäre - Spurengase (Fortsetzung)

Zeit: Donnerstag 8:30–11:45 Raum: GW2 B3009

Hauptvortrag UP 10.1 Do 8:30 GW2 B3009

Application of the FTIR-spectroscopy in the infared via remote sensing and in-situ techniques for studying the carbon cycle — •Justus Notholt, Thorsten Warneke, Mathias Palm, Matthias Buschmann, Denise Müller, Christof Petri, Yuting Wang, and Zhiting Wang — IUP, University of Bremen

Remote sensing has been established as a powerful method for studying the atmospheric composition. Using the sun or moon as light source and working in the infrared spectral region using FTIR spectrometers allows measuring the total column concentrations of up to 20 atmospheric trace gases. Analyzing the spectral line shape allows for a few trace gases to derive the concentration profile in 2-4 atmospheric layers up to about 30 km. The observations at about 30 sites worldwide are organized in two international networks, the NDACC (Network for Atmospheric Composition Change) and TCCON (Total Carbon Column Observing Network). Together with model studies the observations have been used to study the atmospheric carbon cycle. Recent results will be presented and discussed.

The relevance of inland waters for the carbon cycle is not well known. Rivers are often treated as passive pipes, which means, the amount of carbon that enters the rivers reach the ocean. Recently an in situ measurement technique based on FTIR-spectrometry has been developed for studying the trace gas fluxes between inland waters and the atmosphere. FTIR spectrometry allows the simultaneous measurement of different trace gases and their isotopes in the atmosphere and in the water. Recent results will be presented and discussed.

UP 10.2 Do 9:00 GW2 B3009

Measurements of the tropospheric column of Ammonia (NH3) above Ispra, Italy. — •Mathias Palm[1], Justus Notholt[1], and Niels Jensen[2] — [1]Universität Bremen — [2]JRC Ispra

Ammonia (NH3) is one of the central compounds in the nitrogen in the soil-atmosphere system. It is a highly reactive molecule and difficult to measure because of it properties. Ammonia plays a central part in the development of smog via its reaction with nitric acid (HNO3) to form ammonium nitrate (NH4NO3).

During a measurement campaign the tropospheric column of Ammonia (NH3) has been measured in solar absorption mode in Ispra, Italy from Spring to Autumn 2016 using a mobile FTIR system. Ispra is located adjacent to the Po valley, a agricultural center in Italy and one of the hot spots for Ammonia in Western Europe. Due to its location it can get air either from the Po-valley, air which travelled over the Alps or air originating on the Mediterranian. This location makes it a valuable place for measurements and a demanding place for model validation.

In this presentation, results from the measurement campaign and first comparisons with the LOTOS-Euro model will be presented. The flexpart model is used to calculate footprints, i.e. source regions for the measured ammonia.

UP 10.3 Do 9:15 GW2 B3009

Das IUP-Bremen imaging DOAS Instrument IMPACT: Charakterisierung und erste Anwendung — •Enno Peters[1], Mareike Ostendorf[1], Anja Schönhardt[1], Andreas Richter[1], André Seyler[1], Folkard Wittrock[1], Stefan Schreier[1], Mihalis Vrekoussis[2] und John P. Burrows[1] — [1]Institut für Umweltphysik, Universität Bremen, Bremen, Deutschland — [2]Zentrum für Marine Umweltwissenschaften (MARUM), Bremen, Deutschland

Dieser Beitrag behandelt die Entwicklung eines neuartigen, bodengebundenen Messgerätes IMPACT (Imaging MaPper for AtmospheriC observaTions), das auf der Differentiellen Optischen Absorptions-Spektroskopie (DOAS-Methode) beruht, einer in der Fernerkundung eingesetzten Technik zur Messung atmosphärischer Spurengase. Im Gegensatz zu herkömmlichen DOAS-Geräten, die Spurengasabsorptionen aus nur einer Richtung zur Zeit detektieren, misst das Imaging-Gerät simultan in 50 vertikalen Richtungen und ist gleichzeitig im Azimut (0°-360°) motorisiert schwenkbar. So entstehen vollständige hemisphärische Bilder der Stickstoffdioxidverteilung (NO2) sowie O4 um den Messstandort herum mit einer zeitlichen Auflösung von ca. 15 Minuten, was Aufschlüsse über die lokalen Quellen, sowie den Tagesgang und Transport von Stickoxiden ermöglicht.

Neben der Charakterisierung des Instruments werden erste Daten und Ergebnisse präsentiert, die auf der internationalen Feldkampagne CINDI-2 gewonnen wurden, an der das Instrument im Sommer 2016 in Cabauw, Niederlande, teilnahm.

UP 10.4 Do 9:30 GW2 B3009

Development of a multi-model Air Quality Forecasting System for China — •Anna Katinka Petersen, Idir Bouarar, and Guy Brasseur — Max Planck Institut für Meteorologie, Hamburg, D

As part of the EU-sponsored projects Panda and MarcoPolo, a multimodel air quality prediction system including 7 models has been developed, providing daily forecasts of ozone, nitrogen dioxide, PM10 and PM2.5 for China. We will describe the forecasting system and show examples of forecasts produced for several Chinese cities and displayed on a web site developed by the Dutch Meteorological service (KNMI). A discussion on the accuracy of the predictions based on a detailed evaluation process using surface measurements from the Chinese monitoring network will be presented.

UP 10.5 Do 9:45 GW2 B3009

Methane retrieval and interpretation using high spatial resolution AVIRIS-NG radiances — •Jakob Borchardt[1], Konstantin Gerilowski[1], Sven Krautwurst[1], Thomas Krings[1], David R. Thompson[2], Andrew K. Thorpe[2], Christian Frankenberg[2,3], Michael Buchwitz[1], Michael Eastwood[2], Robert O. Green[2], Heinrich Bovensmann[1], and John P. Burrows[1] — [1]Institute of Environmental Physics (IUP), University of Bremen, P.O. 330440, 28334 Bremen, Germany — [2]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA 91109, California, USA — [3]California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA 91109, California, USA

Methane (CH_4) is an important greenhouse gas whose sources and sinks on regional scale are not well quantified. The AVIRIS-NG imaging spectrometer allows for source attribution with high spatial resolution ($\lesssim$ 4 x 4 m^2). The quantitative retrieval of CH_4 total column variations with the "Weighting Function Modified - DOAS" algorithm (WFM- DOAS) originally developed for medium and high spectral resolution instruments ($\lesssim$ 1 nm) was successfully applied to the lower spectral resolution ($\sim$ 5.5 nm) AVIRIS-NG data. The source under investigation was a coal mine ventilation shaft located in the Four Corners region, which is known for it's high CH_4 emissions. In this talk, the adaptation of the WFM-DOAS algorithm to imaging spectroscopy measurements and the flux inversion using a mass balance approach will be presented.

Kaffeepause (30 min)

UP 10.6 Do 10:30 GW2 B3009

Near-surface-sensitive satellite observations of atmospheric greenhouse gases (CO2, CH4): Past, present and future — •Michael Buchwitz, Maximilian Reuter, Oliver Schneising, Jens Heymann, Heinrich Bovensmann, and John P. Burrows — Universität Bremen FB1, Institut für Umweltphysik (IUP), Otto Hahn Allee 1, 28334 Bremen

Carbon dioxide (CO2) and methane (CH4) are Essential Climate Variables (ECVs) because they are important greenhouse gases contributing to global warming. Despite their importance our knowledge about their variable sources and sinks has significant gaps. Near-surface-sensitive global satellite observations of atmospheric CO2 and CH4 in combination with inverse modelling or other approaches helps to close important knowledge gaps. At the Institute of Environmental Physics (IUP) of the University of Bremen (UB) column-averaged dry-air mole fractions of CO2 and CH4, i.e., XCO2 and XCH4, are retrieved from the European satellite instrument SCIAMACHY on ENVISAT and from the Japanese instrument TANSO-FTS onboard GOSAT. Furthermore, IUP-UB is leading two European projects focusing on satellite retrievals of XCO2 and XCH4 and IUP-UB was and is also involved in the specification of future satellites. In this presentation an overview about these activities will be given.

UP 10.7 Do 10:45 GW2 B3009

Wie viel CO_2 wird von der Biosphäre der europäischen Land-

massen aufgenommen? — •Maximilian Reuter, Michael Buchwitz, Jens Heymann, Oliver Schneising, Heinrich Bovensmann und John P. Burrows — Institut für Umweltphysik, Universität Bremen, Deutschland

Die Biosphäre der europäischen Landmassen vom Atlantik bis zum Ural nimmt große Mengen des Treibhausgases CO_2 auf. Die Größe dieser CO_2 Senke wurde in der Vergangenheit über verschiedene satelliten- und bodengestützte Verfahren bestimmt. Neben ihrer politischen Relevanz, ist eine gute Kenntnis der europäischen CO_2 Senke z.B. wichtig für das Verständnis des globalen Kohlenstoffzyklus und somit vertrauenswürdiger Klimavorhersagen. Dennoch weichen die derzeitigen Schätzungen stark voneinander ab und die Unterschiede sind nur schlecht verstanden. In unserem Beitrag werden wir den derzeitigen Stand der Forschung erörtern und Ergebnisse aktueller Studien basierend auf satellitengestützten Verfahren präsentieren, die darauf ausgelegt sind die Unterschiede besser zu verstehen.

Hauptvortrag UP 10.8 Do 11:00 GW2 B3009

Ozone recovery and climate change: Towards an interactive representation of stratospheric ozone in Earth System Models — •Markus Rex, Ingo Wohltmann, Daniel Kreyling, Ralph Lehmann, and Wolfgang Dorn — Alfred-Wegener-Institut, Helmholtz Zentrum für Polar- und Meeresforschung, Potsdam, Germany

Interactions between climate change and stratospheric ozone modify both, the evolution of surface climate and the recovery of the stratospheric ozone layer. Accounting for the climate feedbacks from changing ozone as well as the impact of climate change on the evolution of the ozone layer requires the interactive representation of stratospheric chemistry in Earth System Models.

Our understanding of stratospheric ozone chemistry is now mature at the process scale and state of the art Chemical Transport Models (CTM) result in a realistic representation of the global ozone layer and the chemical processes affecting it. But the huge computational effort of these models makes it difficult to include the ozone layer interactively in Earth System Models (ESMs).

We have developed SWIFT, an extremely fast module for interactive ozone chemistry in climate models. SWIFT allows for an interactive treatment of stratospheric ozone in standard ESMs with little numerical overhead. We will present the current status of SWIFT and results from coupling SWIFT to a climate model.

UP 10.9 Do 11:30 GW2 B3009

Do recent observed stratospheric ozone trends indicate ozone recovery? — •Mark Weber[1], Wolfgang Steinbrecht[2], Stacey Frith[3], Nabiz Rahpoe[1], Melanie Coldewey-Egbers[4], Doug Degenstein[5], and Lucien Froidevaux[6] — [1]Universität Bremen FB1, Bremen, Germany — [2]Deutscher Wetterdienst, Hohenpeissenberg, Germany — [3]NASA Goddard Space Flight Center, Grenbelt, MD, USA — [4]DLR Oberpfaffenhofen, Wessling, Germany — [5]University of Sasketchewan, Saskatoon, Canada — [6]Jet Propulsion Laboratory, Pasadena, CA, USA

Due to the successful phase-out of ozone-depleting substances (ODS) following the Montreal Protocol, ozone is supposed to slowly recover. As the stratospheric halogen (resulting from ODS) is decreasing at a slow rate (as compared to the rate of increase before the 1990s), ozone recovery will be quite slow. Due to the large year-to-year variability in ozone, ODS related trends are thus difficult to establish. So far positive ozone trends since 2000 were only statistically significant in the upper stratosphere according to the recent WMO ozone assessment. In addition to the high variability in ozone, potential instrumental drifts of satellite data add to trend uncertainties. In this presentation actual ozone trends are reported using available and updated total ozone and ozone profile satellite data. Attribution of the observed trends and uncertainties due to long-term stability of the satellite data will be discussed.