# UP 11: Postersession

Time: Wednesday 17:00–18:30 Location: MAG Poster

UP 11.1 Wed 17:00 MAG Poster

**Transmissionsprofile aus SCIAMACHY Sonnenokultationsmessungen** — •Jacob Zalach und Christian von Savigny — Ernst-Moritz-Arndt-Universität, Greifswald

Vertikale Transmissionsprofile der Atmosphäre liefern Informationen über ihre Beschaffenheit und erlauben die Bestimmung der Verteilung ihrer Bestandteile. Im Rahmen des ROMIC-ROSA Projektes sollen stratosphärische Aerosolextinktionsprofile und ihre Teilchengrößenverteilung ermittelt werden, wofür zunächst die zugehörigen Transmissionsprofile vorliegen müssen.

Eine etablierte Methode zur Messung dieser Profile sind satellitengestützte Okkultationsmessungen. Die Sonnenokkultationsmessungen des SCIAMACHY-Spektrometers (EnviSat) erstrecken sich über einen Zeitraum von zehn Jahren und decken den Wellenlängenbereich von 240 bis 2380 nm ab. Sie wurden bisher noch nicht vollständig ausgewertet. Eine direkte Übernahme existierender Auswerteverfahren ist nicht möglich, vor allem wegen der unterschiedlichen räumlichen Auflösung der Sonnenprofile. Um Transmissionswerte für vorgegebene Tangentenhöhen direkt aus den Messungen entnehmen zu können, müssen bestehende Verfahren an die vorliegenden Datensätze angepasst werden.

Dieser Beitrag stellt die bisher angewandte Datenaufbereitung zur Diskussion und zeigt die so gewonnenen Transmissionsprofile.

UP 11.2 Wed 17:00 MAG Poster

**Remote sensing of methane with optical correlation spectroscopy on the Q-branch of the 2$\nu$3 band** — •Katja Rieth[1,3], Christophe Anselmo[1], Benjamin Thomas[2], Jean-Pierre Cariou[4], Alain Miffre[1], Johannes Orphal[3], and Patrick Rairoux[1] — [1]Institut Lumière Matière (ILM), Université Lyon 1, CNRS, Lyon, France — [2]Center for Advanced Technology (CAT), City University New York, USA — [3]Institute for Meteorology and Climate Research Research (IMK), Karlsruhe Institute of Technology (KIT) , Germany — [4]Leosphere, Orsay, France

We propose a study on the ability to realize accurate remote sensing of greenhouse gases concentration in the Earth's atmosphere by applying broadband optical correlation spectroscopy (OCS) with Acoustic Optical Programmable Dispersive Filter (AOPDF) [1]. Our study focuses on the 2$\nu$3 methane absorption band, centered at the 1665 nm wavelength. Studies have been achieved to assess the accuracy on the retrieved methane-mixing ratio when applying the OCS-AOPDF methodology. We will show that atmospheric temperature gradient induces a systematic error on the retrieved methane-mixing ratio and that methane-mixing ratios are weakly sensitive to the pressure broadening of the absorption line and to the statistical variation of the absorption line strength [2]. References [1] B. Thomas, A. Miffre, G. David, C. Anselmo, J.P. Cariou and P. Rairoux, App. Phys. B, 113, 265-275, (2013). [2] B. Thomas, A. Miffre, G. David, C. Anselmo, E. Coillet, J.P. Cariou and P. Rairoux, , J. Mol. Spec., 293, 3-8,(2013).

UP 11.3 Wed 17:00 MAG Poster

**A multi-wavelength retrieval of tropospheric $NO_2$ from GOME-2 observations** — Andreas Richter, •Andreas Hilboll, and John P. Burrows — Institut für Umweltphysik, Universität Bremen, Bremen, Deutschland

Satellite observations of tropospheric $NO_2$ columns are frequently used when applying satellite measurements in atmospheric pollution research. They have been used for the identification and evaluation of natural and anthropogenic $NO_x$ emissions and their changes over time, for process studies, and for the investigation of atmospheric transport events.

One limitation of the commonly used DOAS retrieval of $NO_2$ columns from satellite observed radiances is the lack of vertical resolution. Together with the altitude-dependence of retrieval sensitivity, this necessitates the use of a priori information on the $NO_2$ vertical profile. This is one of the major sources of uncertainties in the retrieval, which could be reduced if information on the vertical location of the $NO_2$ could be retrieved from the measurements themselves.

In this study, the vertical information content of nadir $NO_2$ observations in the wavelength range 400–500 nm is investigated using both synthetic spectra and real GOME-2 measurements over polluted regions. We show that at least for cloud free scenes, some information on the vertical location of tropospheric $NO_2$ plumes can be retrieved. Limitations of the method as well as possible applications for future sensors such as S-5P are discussed.

UP 11.4 Wed 17:00 MAG Poster

**Comparing RD94 dropsonde and aircraft temperature and humidity measurements based on data from arctic field studies** — •Lukas Schmidt[1], Marion Maturilli[1], Roland Neuber[1], Klaus Dethloff[1], and Andreas Herber[2] — [1]Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Potsdam, Germany — [2]Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany

Dropsondes are launched from research aircraft to measure vertical profiles of temperature, humidity, pressure and wind in the atmosphere while falling to the ground. Onboard the aircraft Polar 5 of the Alfred Wegener Institute for Polar and Marine Research (AWI), they are deployed on arctic and antarctic campaigns.

Here we compare temperature and humidity data from Vaisala RD94 dropsondes with data from the permanently installed sensors of the aircraft. Dropsonde profiles are combined with profiles measured during ascent or descent by the aircraft nearby. The aerosol lidar AMALi is used to identify the presence and altitude of clouds. Furthermore the time constants of the dropsonde temperature and humidity sensors are deduced from atmospheric data.

The overall agreement between aircraft and dropsonde data is good, but for high humidities as in clouds the dropsonde shows a systematic dry bias of almost 10%. Data suggest a temperature dependency of this bias. The combination of dry bias and time lag of the sensors can make cloud detection from dropsondes alone difficult in cold environments.

UP 11.5 Wed 17:00 MAG Poster

**Long-Term Changes in Temperature and Radiation at the Arctic Station Ny-Ålesund (79°N, 12°E)** — •Marion Maturilli[1], Andreas Herber[2], and Gert König-Langlo[2] — [1]Alfred-Wegener-Institut, Helmholtz Zentrum für Polar- und Meeresforschung, Potsdam — [2]Alfred-Wegener-Institut, Helmholtz Zentrum für Polar- und Meeresforschung, Bremerhaven

At the Franco-German AWIPEV Arctic research base in Ny-Ålesund (79°N, 12°E), Svalbard, surface radiation measurements have been operated since 1992 in the frame of the Baseline Surface Radiation Network (BSRN). The data are complemented with surface meteorology measurements since 1993, contributing to the study of climate change in the Arctic with focus on alpine/marine landscape. Over the last 20 years, changes both in surface radiation and temperature have been observed in Ny-Ålesund. An increase of the annual mean temperature of +1.4 +/-0.8 K per decade indicates a substantial warming of the Ny-Ålesund environment, accompanied by an increase of the annual mean radiation budget of +4.9 +/-2.9 Wm-2 per decade. Separating the annual radiation budget to its different contributions it turns out that by far the largest changes are observed in the increasing longwave radiation during the winter season. In fact, also the temperature increase is largest during the winter season, with +3.3 +/-2.6 K per decade. In the recent warmer winters, precipitation has often occurred in the form of rain rather than snow. Furthermore, changes in reflective solar radiation indicate an earlier onset of the snow melt by 1 week compared to 20 years ago.

UP 11.6 Wed 17:00 MAG Poster

**Long-term changes of tropospheric $NO_2$ over megacities derived from multiple satellite instruments** — •Andreas Hilboll, Andreas Richter, and John P. Burrows — Institut für Umweltphysik, Universität Bremen, Bremen, Deutschland

Nitrogen oxides ($NO_x$ = NO+$NO_2$) in the troposphere have been retrieved from satellite-based measurements by the GOME, SCIAMACHY, OMI, and GOME-2 instruments since the mid 1990s, using the DOAS technique. These instruments differ in spatial resolution, local time of measurement, viewing geometry, and other details.

In this study, we present two ways to account for instrumental differences in trend analyses of the tropospheric $NO_2$ columns derived from these measurements, while preserving the individual instruments' spatial resolutions. The first method explicitly accounts for the in-

struments' difference in ground pixel size (40×320 km$^2$ vs. 30×60 km$^2$ for GOME and SCIAMACHY), based on spatial averaging of the measured earthshine spectra and extraction of a spatial pattern of the resolution effect. The second method is an empirical correction, which summarizes all instrumental differences by including instrument-dependent offsets in a fitted trend function.

Both approaches show consistent trends of tropospheric $NO_2$ for a selection of areas on both regional and city scales. Measured tropospheric $NO_2$ columns have been increasing by a factor 3 over east-central China. On a megacity level, individual trends can be as large as +27.2±3.9% yr$^{-1}$ and +20.7±1.9% yr$^{-1}$ in Dhaka and Baghdad, while Los Angeles shows a strong decrease of -6.00±0.72% yr$^{-1}$.

UP 11.7 Wed 17:00 MAG Poster

**Spatial distributions of $NO_2$ in emission plumes observed by imaging DOAS from aircraft** — •Anja Schönhardt[1], Andreas Meier[1], Andreas Richter[1], Thomas Ruhtz[2], Carsten Lindemann[2], and John P. Burrows[1] — [1]Institut für Umweltphysik, Universität Bremen — [2]Institut fuer Weltraumwissenschaften, Freie Universität Berlin

Nitrogen dioxide, $NO_2$, is an important reactive trace gas in the troposphere leading to ozone formation as well as acidification and eutrophication of ecosystems. $NO_2$ is produced from nitric oxide, NO, mainly emitted by combustion processes. The IUP Bremen AirMAP (Airborne imaging DOAS instrument for Measurements of Atmospheric Pollution) has been used for $NO_2$ observations over point sources and polluted areas during aircraft campaigns in 2011 and 2013. The instrument yields $NO_2$ column densities at fine horizontal resolution (below 100m, down to 30m), and at good spatial coverage. Within only a few minutes, $NO_2$ maps covering areas of several km$^2$ are obtained. Aircraft observations of spatial $NO_2$ distributions are presented, and the obtained maps reveal large spatial variability of $NO_2$, which is made possible by the AirMAP imaging capabilities. In particular, strongly non-uniform distributions of $NO_2$ within emission plumes downwind of point sources are discovered. The observations have implications for experimental emission estimates, the deduced relevance of emission sources and downwind chemistry. In this study, the $NO_2$ amounts and their particularly non-uniform distributions, resulting from chemical transformation and atmospheric dynamics, are investigated.

UP 11.8 Wed 17:00 MAG Poster

**A Central Facility for Greenhouse Gas Analyses within the ICOS Network (Integrated Carbon Observation System)** — Maria Büttner, Michael Hielscher, Stephan Baum, Bert Steinberg, Adam Janoschka, Christian Lütz, Rico Hengst, Markus Eritt, •Daniel Rzesanke, and Armin Jordan — Max Planck Institute for Biogeochemistry, ICOS-Central Flask and Calibration Laboratory, Kahlaische Str. 4, 07745 Jena/Germany

The Integrated Carbon Observation System (ICOS) is an European-wide research infrastructure that aims at providing high quality observational data for the long-term monitoring of the European greenhouse gases balance. We are currently building up the Flask and Calibration Laboratory (FCL) in Jena, a central facility of the ICOS research infrastructure. It will be responsible for measurements of $CO_2$, $CH_4$, $N_2O$, CO, $H_2$, $SF_6$ and $O_2/N_2$ ratios as well as stable isotope analyses ($CO_2$ and $CH_4$) of flask air samples collected at atmospheric and oceanic observing platforms of the ICOS monitoring network.

The second major task of the FCL is the provision of real air reference standards calibrated relative to the respective WMO calibration scales for the calibration and quality control of continuous measurement systems at the monitoring stations. Furthermore, a relational database management an QC/QA system is being developed in collaboration with colleagues of the ICOS Central Radiocarbon Laboratory at Heidelberg and the Atmospheric Thematic Centre near Paris.

In our contribution we will give an overview of the new institution, its instrumentation and the mode of operation.

UP 11.9 Wed 17:00 MAG Poster

**Custom-designed optical measurement cell for temperature-dependent FTIR measurements of spectral line data** — •Anton Serdyukov, Anne Rausch, Viktor Werwein, Jens Brunzendorf, Olav Werhahn, and Volker Ebert — Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig, Germany

Accurately determined spectral line parameters are an important input to each atmospheric monitoring activity. It is also important to know the temperature dependency of these parameters because of the broad temperature distribution in the atmosphere.

In the framework of the EMRP project EUMETRISPEC, a measurement cell was developed to allow for infrared measurements of gas samples at well defined environmental parameters – i.e. temperature, pressure and optical path-length. The massive copper body with the custom temperature stabilization design in combination with a refrigerated-heating circulator allows an accurate and stable temperature regulation of the gas sample in the range from -60 to +90°C. A special design of the cell windows ensures a reproducible optical path length, independent of varying gas pressures inside the cell.

We report on the cell design and present our first temperature-dependent measurements of carbon monoxide in the 2-0 band in the temperature range from -60 to +23°C at 300 mbar.

Acknowledgement: The European Metrology Research Programme (EMRP) is jointly funded by the EMRP participating countries within EURAMET and the European Union.

UP 11.10 Wed 17:00 MAG Poster

**$CO_2$ self broadening and line strength measurements in the 2 $\mu$m region** — •Jens Brunzendorf, Anton Serdyukov, Anne Rausch, Viktor Werwein, Olav Werhahn, and Volker Ebert — Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig, Germany

$CO_2$ is one of the most important greenhouse gases. It is frequently monitored via satellites and ground-based stations using e.g. Fourier Transform Infrared (FTIR) spectrometers, often in the 2 $\mu$m region. Absolute $CO_2$ concentration retrievals can be improved with enhanced $CO_2$ spectral line parameters, which are preferably traceable to national standards.

Based on an FTIR instrumentation which has been setup in the framework of the European Metrology Programme (EMRP) we present measurements of $CO_2$ line parameters in the 2 $\mu$m wavelength region. We address the standardization of line data measurements and their uncertainty assessments facilitating measurements of spectral line data under well controlled conditions with traceable instruments. In particular, we present the FTIR spectrometer, the data reduction as well as the $CO_2$ spectra of the three bands around 2 $\mu$m. Retrieved self broadening coefficients and line strength data will be presented.

Acknowledgement: This work was performed within the European joint research project EUMETRISPEC (www.eumetrispec.org) funded by the EMRP. The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union.

UP 11.11 Wed 17:00 MAG Poster

**Morphogenesis of short-time frozen microstructures in sea ice** — •Bernd Kutschan[1], Silke Thoms[2], Klaus Morawetz[1,3,4], and Sibylle Gemming[5] — [1]Münster University of Applied Sciences, Stegerwaldstrasse 39, 48565 Steinfurt, Germany — [2]Alfred Wegener Institut, Am Handelshafen 12, D-27570 Bremerhaven, Germany — [3]International Institute of Physics (IIP), Avenida Odilon Gomes de Lima 1722, 59078-400 Natal, Brazil — [4]Max-Planck- Institute for the Physics of Complex Systems, 01187 Dresden, Germany — [5]Institute of Ion Beam Physics and Materials Research, Helmholtz- Zentrum Dresden-Rossendorf, P.O. Box 51 01 19, 01314 Dresden, Germany

Microstructures of salty water in sea ice are a unique habitat for microorganisms with a remarkable adaptibility to extreme environmental conditions. We model the early phase of brine entrapment in sea ice without salinity conservation by a Turing model and with salinity conservation by a phase field theory. The theory includes both macroscopic salt diffusion and microscopic order parameter dynamics describing the different symmetries, hexagonal ice and liquid water. The first structures emerging during sea-ice formation are determined by the phase instability of the ice-water system in the presence of salt. Realistic parameters allow to calculate a phase diagram and two-dimensional microstructures found in agreement with the measured samples. From a methodical perspective our approach could also be used to describe the morphology of ice and snow crystals. The research is supported by DFG-Priority Program 1158.

UP 11.12 Wed 17:00 MAG Poster

**Freezing mechanisms of antifreeze proteins** — •Bernd Kutschan[1], Silke Thoms[2], Klaus Morawetz[1,3,4], and Sibylle Gemming[5] — [1]Münster University of Applied Sciences, Stegerwaldstrasse 39, 48565 Steinfurt, Germany — [2]Alfred Wegener Institut, Am Handelshafen 12, D-27570 Bremerhaven, Germany — [3]International Institute of Physics (IIP), Avenida Odilon Gomes de Lima 1722, 59078-400 Natal, Brazil — [4]Max-Planck- Institute for the Physics

of Complex Systems, 01187 Dresden, Germany — [5]Institute of Ion Beam Physics and Materials Research, Helmholtz- Zentrum Dresden-Rossendorf, P.O. Box 51 01 19, 01314 Dresden, Germany

The fascinating ability of algae, insects and fishes to survive at temperatures below normal freezing is realized by antifreeze proteins (AFPs). The mechanism of these proteins and how they inhibit the freezing of water is still an open question. We extend our earlier phase-field models for salt channel formation in sea ice to simulate and explain the mechanism of AFPs. We suggest a new thermodynamic hysteresis process stabilizing the supercooled liquid state by a non-equilibrium effect which explains the non-colligative behaviour of antifreeze proteins. The research is supported by DFG-Priority Program 1158.

UP 11.13 Wed 17:00 MAG Poster

**Determination of sea ice concentration during summer using 1.4 GHz brightness temperatures** — •Valentin Ludwig[1] and Lars Kaleschke[2] — [1]Raum 020, Institut für Meereskunde, Universität Hamburg, Bundesstraße 53, ZMAW-Gebäude, 20146 Hamburg — [2]Raum 016, Institut für Meereskunde, Universität Hamburg, Bundesstraße 53, ZMAW-Gebäude, 20146 Hamburg

An algorithm for the sea ice concentration retrieval from passive microwave data acquired in the protected frequency band of 1400-1427 MHz (L-band) was developed. It had been hypothesised that the wide range between the emissivities of open water and sea ice in L-band causes a high sensitivity towards low and intermediate ice concentrations. Previously used sensors had shown large uncertainties in low ice concentrations or were not even able to measure them at all. Additionally, the atmospheric influence can mostly be neglected in L-band. The results of this study indeed indicate the potential of the Soil Moisture and Ocean Salinity (SMOS) satellite in showing lower, physically consistent, sea ice concentrations than the Special Sensor Microwave/Imager (SSM/I) during the melting period 2012. Sea ice concentration uncertainties were found to be low for low and intermediate sea ice concentrations. A validation with Moderate Resolution Imaging Spectrometer (MODIS) infrared images shows good agreement with SMOS in low and intermediate ice concentrations. SMOS tends to underestimate high sea ice concentrations which exceed 80%. Additionally, clear 100% - 0% sea ice concentration jumps are smeared out due to the coarse spatial resolution.