UP 9: Methoden II

Zeit: Donnerstag 16:30–17:48 Raum: VMP 8 R206

Hauptvortrag UP 9.1 Do 16:30 VMP 8 R206

Sensing methane, carbon dioxide and water vapour isotopologues from space - Results from SCIAMACHY onboard ENVISAT — •Christian Frankenberg — Netherlands Institute for Space Research, Utrecht

Methane is, after Carbon dioxide, the second most important anthropogenic greenhouse gas. SCIAMACHY from its vantage point in space offers the unique opportunity to measure methane concentrations globally with high sensitivity towards the surface. Previous investigations of SCIAMACHY-observed methane received much attention since they pointed to grossly underestimated emissions in the tropics. Until then, tropical methane emissions were speculated to be very important but were weakly constrained in absence of suitable measurements. We will present an overview of the findings so far and report new results from a revised retrieval version using updated spectroscopic parameters. We will present how satellite measurements can be used to invert sources by means of a four-dimensional variational (4D-Var) data assimilation system. Further, we will give an overview of the latest status of Carbon Dioxide retrievals from different research groups using SCIAMACHY and a short outlook of the potential of the OCO and GOSAT satellites to be launched in January 2009. In addition, we will show latest results of retrievals of deuterated water vapour from SCIAMACHY spectra and how it can be used to gain information on hydrological cycles and processes determining isotope fractionations.

UP 9.2 Do 17:00 VMP 8 R206

Integrated Retrieval of Surface and Atmospheric Parameters over the Arctic from AMSR-E Satellite Microwave Radiometer Data Using Inverse Methods — •Christian Melsheimer[1], Leif Toudal Pedersen[2], and Georg Heygster[1] — [1]Institute of Environmental Physics, University of Bremen, Germany — [2]Danish Meteorological Institute, Copenhagen, Denmark

For the polar regions, there is a constant lack of data on the state of the surface and atmosphere because of too few direct observations. Therefore, satellite remote sensing of surface and atmospheric parameters in polar regions is essential for understanding and predicting weather and climate.

Here we present a method for the retrieval of atmospheric and surface parameters (namely, surface wind speed, total water vapor, cloud liquid water, surface temperature, ice concentration, multiyear ice fraction) over the Arctic Ocean from brightness temperature measurements by the spaceborne microwave radiometer AMSR-E (Advanced Microwave Scanning Radiometer for EOS) on the satellite Aqua. We use an inverse method, with a forward model based on a fast radiative transfer model for AMSR-E over open ocean which we have extended by including the possibility of ice-covered or partly ice-covered sea, using new data on sea ice emissivity at AMSR-E frequencies. The method performs reasonably well and can even retrieve cloud liquid water over ice, and ice concentration in the marginal ice zone in cloudy and humid conditions.

UP 9.3 Do 17:12 VMP 8 R206

The SO2 camera - a novel method for quantifying spatial SO2 distributions at high time resolution. — •Markus Woehrbach, Christoph Kern, Leif Vogel, Matthias Fickel, and Ulrich Platt — Institut fuer Umweltphysik, University of Heidelberg, Heidelberg, Germany

Sulfur dioxide (SO_2) distributions in volcanic plumes are typically determined via spectroscopic measurements in scanning-mode or through instrument traverses. The SO_2 camera system presented here records two-dimensional images of the SO_2 distribution at a high temporal resolution and therefore allows the measurement of spatial and temporal variations in the SO_2 distribution that can not be resolved by spectroscopic techniques.

For this, two-dimensional images of the volcanic plume are alternately acquired with a UV-sensitive CCD-camera through two selected bandpass filters. The central wavelength of the first filter is chosen around 310 nm, a wavelength region in which SO_2 absorption is prominent, while the second filter is transparent at around 325 nm and therefore outside the strong SO_2 absorption bands. Intensity ratios of identical picture elements yield the required spectral information for SO_2 detection and quantification.

In recent field studies SO_2-fluxes up to 2000 t/day could be determined at Mt. Etna, Sicily. A dependency of the absorption signal on the spectral characteristics of the prevalent illumination conditions was discovered, with an observable diurnal variation of roughly 10% for sunny days and high variability for overcast days.

UP 9.4 Do 17:24 VMP 8 R206

Passive airborne remote-sensing measurements of atmospheric methane (CH4) and carbon dioxide (CO2) with the MAMap instrument: an overview of measurements performed during 2007 and 2008. — •Konstantin Gerilowski[1], Andreas Tretner[2], Michael Buchwitz[1], Jörg Erzinger[2], John Burrows[1], and Heinrich Bovensmann[1] — [1]Institute of Environmental Physics (IUP), University of Bremen, Otto-Hahn-Allee 1, PO Box 33 04 40, 28334 Bremen, Germany — [2]German Research Centre for Geosciences (GFZ), Telegrafenberg Haus B, 14473 Potsdam, Germany

The Methane Airborne Mapper (MAMap) was designed for passive remote sensing of atmospheric CH4 and CO2 columns between aircraft and Earth's surface. The instrument is specified to detect mixing ratio variations <3% (total column) of the atmospheric background below the aircraft with a ground pixel size of 20m x 20m (700m flight height, 200 km/h flight speed). It allows the detection of CH4 and CO2 gradients on a local and regional scale and provides a link between ground-based and satellite-based measurements. For data processing a modified version of SCIAMACHY's WFM-DOAS algorithm has been applied. In 2007 and 2008 several flight campaigns over wetlands and power plants have been carried out and correlated to ground-based measurements. In November 2008 also a transect from Oshawa (Canada) to Punta Arenas (Chile) was conducted onboard the AWI POLAR 5 aircraft. To demonstrate the instrument's performance, a set of MAMap measurements from different targets will be presented.

UP 9.5 Do 17:36 VMP 8 R206

Implementing automated wavelength calibration and parameterization of the optical transfer function in DOAS data retrievals — •Thomas Lehmann, Christoph Kern, Leif Vogel, and Ulrich Platt — Institut fuer Umweltphysik, University of Heidelberg, Heidelberg, Germany

Differential Optical Absorption Spectroscopy (DOAS) is an universal technique to measure the concentrations of atmospheric trace gases. The quality of DOAS data retrievals depends mainly on the reproduction ("fitting") of measured trace gas optical densities with an appropriate model function. Exact knowledge of the wavelength calibration of the measured spectra and an accurate parameterization of the spectrometer's optical transfer function (OTF) are both critical in obtaining optimal evaluation results. There is a need to improve current DOAS retrieval algorithms for several reasons: To begin with, the in-situ calibration and determination of the OTF are often elaborate and inaccurate, as both may vary throughout the measurement. Standard DOAS retrievals typically assume an OTF constant in time and for all wavelengths, but the true OTF is usually a function of spectrometer temperature and wavelength. An advanced DOAS retrieval was developed which dynamically re-calibrates the measured spectra using available Fraunhofer lines and computes a wavelength-depending OTF. The retrieval is implemented as an enhanced Levenberg-Marquardt Fit inside the DOASIS evaluation software.