UP 16: Atmosphärische Spurengase und Aerosole: Instrumentelles

Time: Tuesday 16:15–17:45 Location: H48

UP 16.1 Tue 16:15 H48

Messungen gasförmiger Schwefelsäure im Abgas von Dieselmotoren — •Tanja Schuck[1], F. Arnold[1], L. Pirjola[2,3], J. Keskinen[4], T. Rönkkö[4], T. Lähde[4], K. Hämeri[2,5], H. Aufmhoff[1] und D. Rothe[6] — [1]Max Planck Institute for Nuclear Physics — [2]University of Helsinki — [3]Helsinki Polytechnic — [4]Tampere University — [5]Finnish Institute of Occupational Health — [6]MAN Nutzfahrzeuge AG

Zur Verringerung der Rußemissionen von Dieselfahrzeugen kommen immer häufiger katalytische Filtersysteme zum Einsatz. Allerdings bewirken die Partikelfilter auch die Oxidation von Treibstoffschwefel und die Neubildung sogenannter Nanopartikeln mit Durchmessern um 10 nm. Gasförmiger Schwefelsäure wird dabei als Aerosolvorläufergas eine wichtige Rolle zugeschrieben.

Bei Messungen an einem mit Rußfilter ausgerüsteten Fahrzeug konnte erstmals gezeigt werden, dass das Abgas gasförmige Schwefelsäure enthält. Die Messungen ergaben einen Zusammenhang zwischen der Schwefelsäurekonzentration und der Anzahl neugebildeter Teilchen im Abgas.

Systematische Messungen gasförmiger Schwefelsäure im Abgas wurden nun an einem Motorenteststand durchgeführt. Dabei wurde die Konzentration der Schwefelsäure im Abgas gemessen und daraus der Anteil des im Katalysator zu Schwefelsäure umgewandelten Treibstoffschwefels bestimmt. Es wurde Dieselkraftstoff mit unterschiedlichem Schwefelgehalt verwendet und unterschiedliche Abgasnachbehandlungssysteme untersucht.

UP 16.2 Tue 16:30 H48

Development of a broadband cavity enhanced absorption spectrometer using light emitting diodes designed for the detection of NO3 — •Jan Meinen[1], Ulrich Platt[2], and Thomas Leisner[3] — [1]Institut für Physik, Umweltphysik, Technische Universität Ilmenau, 98693 Ilmenau — [2]Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg — [3]Atmosphärische Aerosolforschung, Forschungszentrum Karlsruhe GmbH, 76021 Karlsruhe

A new instrument for measuring the trace gas radical NO3 in the ppt region by optical absorption was developed using a cavity enhanced absorption cell (CEAS). The standard tech-nique of CEAS is very vulnerable to aerosol impact and thus not well suited for direct comparison with differential optical absorption spectroscopy (DOAS) instrument. Using a broad-band light source in CEAS provides the feasibility of employ-ing a DOAS approach in the data acquisition and evaluation. The high level of improvement in light-emitting diode (LED) technology affords a LED driven instrument. This novel light source represents a potentially advantageous alternative to common broadband laser sources for a variety of reasons in-cluding low coast, high durability and reduced power con-sumption. The instrument is self calibrating by pulsing the LED in cavity ringdown approach (CRDS) to obtain mirror reflectivity. The design of the instrument and first results from laboratory measurements of NO3 will be discussed.

UP 16.3 Tue 16:45 H48

New design of Long-Path-Telescopes for atmospheric trace gas measurements based one fibre optic — •André Merten, Jens Tschritter, and Ulrich Platt — Institut für Umweltphysik, Im Neuenheimer Feld 229, 69120 Heidelberg

Long-Path-telescopes are commonly used for atmospheric trace gas measurement, especially in combination with the DOAS (Differential Optical Absorption Spectroscopy) analysis technique. Such an instrument combines the emitting and receiving telescope in one device with a double-Newton-style set-up and a Xe-high pressure lamp as light source and has a typical size from 1..2m. Therefore this instrument requires a high effort in planning and executing of field measurements and it has also a limited signal-to-noise ratio. We developed a new design based on fibre optics, which is easier to handle, more stable in the alignment and also more efficient in the transmission and receiving of light. The use of a fibre coupled light source improves the spectral characteristics especially for light sources with a spatial variation of spectral features like high-pressure arc lamps and LEDs. This new set-up was tested successfully in field measurements. The construction of smaller generation of Long-Path-telescopes is now possible, which would extend the range of the application for this instrument. Together with new economic light source like the LED, this instrument can be used for automatic monitoring of air pollutions.

UP 16.4 Tue 17:00 H48

High Power LEDs as an advantageous alternative to Xenon arc lamps for Long Path DOAS instruments — •Holger Sihler, Christoph Kern, and Ulrich Platt — Institute for Environmental Physics, Heidelberg, Germany

The Long Path Differential Optical Absorption Spectroscopy (LP-DOAS) technique is a well established method for measuring atmospheric trace gases. During recent years steady advances in light emitting diode (LED) technology have led to the applicability of LEDs as light sources for active DOAS instruments. LEDs represent a potentially very advantageous alternative to common thermal emitters for a variety of reasons including low cost, high durability, no risk of explosion and reduced power consumption. The spectral radiance of high power LEDs is of the same order of magnitude as that of xenon arc lamps. The need for stabilisation and its realisation will be discussed, including the possible design of a new, more portable LED-powered DOAS instrument. LEDs emitting in the visible spectral range were already used to measure NO_2 and NO_3. Both species play an important role in the chemical processes of the urban boundary layer. Here, first experiences with UV-emitting LEDs to measure further atmospheric trace gases (e.g. SO_2 and CH_2O) will be presented.

UP 16.5 Tue 17:15 H48

The new Compact Cloud and Aerosol LIDAR 'ComCAL': First results of aerosol measurements at midlatitudes and the tropics — •Franz Immler, Raffael Maurer, and Otto Schrems — Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven, Deutschland

We have designed a Compact Cloud and Aerosol Lidar (ComCAL) to detect particles in the entire troposphere with a vertical resolution of 7.5 m and a temporal resolution of 1 min. The system measures the returns of a pulsed Nd:YAG-laser emitting vertically into the atmosphere at the wavelengths 355 nm, 532 nm, and 1064 nm. Beside the elastic backscatter and the depolarisation, the inelastic backscatter between 380 nm and 450 nm can be detected by means of a grating UV/Vis spectrometer and a multi-anode photomultiplier. This set-up allows the detection of aerosol extinction, water vapor profiles and fluorescence of organic aerosol. The new ComCAL system has undergone its crucial test aboard the research vessel Polarstern in October 2005 during a cruise from Bremerhaven to Capetown. Furthermore, it was operated at a midlatitude coastal site (Bremerhaven, 53.5°N;8.5°E) throughout spring and summer of 2006, and at the tropical station in Paramaribo/Suriname (5.8°N, 55.2°W) during the local dry season in September and October 2006. In Paramaribo the aerosol in the boundary layer can be classified by two main types: a marine type with low optical depth, depolarization and no detectable fluorescence on the one hand and a polluted type with high optical depth, no depolarisation but significant fluorescence on the other hand.

UP 16.6 Tue 17:30 H48

Network for Observation of Volcanic and Atmospheric Change (NOVAC) * Remote sensing of volcanic emissions — •Christoph Kern[1], Bo Galle[2], and Ulrich Platt[1] — [1]Institut für Umweltphysik, Universität Heidelberg, Heidelberg, Germany — [2]Chalmers University of Technology, Gothenburg, Sweden

NOVAC is an EU funded project with the aim to establish a global network of stations for the quantitative measurement of volcanic gas emissions. In this project, miniature spectrometers are used to measure scattered light penetrating volcanic plumes. The measured spectra are evaluated using the principle of Differential Optical Absorption Spectroscopy (DOAS). Primarily, the instruments will be used to provide new parameters in the toolbox of the observatories for risk assessment, gas emission estimates and geophysical research on the local scale. In addition, data will be exploited for other scientific purposes e.g. stratospheric ozone depletion studies. Global estimates of volcanic gas emissions and large scale volcanic correlations will be much improved, as the instruments will also allow the large scale validation of satellite instruments, thus bringing the observation of volcanic gas emissions from space a significant step forward. Currently, scanning

Mini-DOAS instruments are being permanently installed at 18 volcanoes worldwide. This presentation will focus on the advantages of the novel instrument, the measurement techniques developed specifically for volcanic emission studies using DOAS remote sensing, and include first results of emission measurements obtained at various volcanoes in the scope of the NOVAC project.