UP 3: Meßtechnik

Time: Wednesday 16:45–19:15 Location: G/gHS

Invited Talk UP 3.1 Wed 16:45 G/gHS

Einsatz kleiner unbemannter Forschungsflugzeuge (UAV) in der Atmosphärenphysik — •Jens Bange — Universität Tübingen, Zentrum für Angewandte Geowissenschaften

Unbemannte und automatisch operierende Kleinflugzeuge (UAV) sind vergleichsweise neue Instrumente der Atmosphärenforschung. Entsprechend ausgelegt, mit schneller und genauer Sensorik ausgestattet ermöglichen sie die Messung der turbulenten Strukturen und Flüsse in der atmosphärischen Grenzschicht. Übliche Messgeräte sind meist zu groß, schwer und verbrauchsintensiv. Daher muss die wissenschaftliche Nutzlast aus erwerblichen Systemen angepasst oder neu entwickelt werden. Da UAV aber eine interessante und kostenreduzierte Alternative zu bemannten Flugzeugen darstellen, wird auf diesem Gebiet seit etwa 10 Jahren intensiv entwickelt.

Kleine Forschungs-UAV werden mittlerweile in vielen meteorologischen Feldexperimenten eingesetzt. Diese Instrumente bieten ähnliche Anwendungsprofile und Datenqualität wie kleine bemannte Forschungsflugzeuge - insbesondere hinsichtlich den thermodynamischen Grundgrößen und der Turbulenzmessung - bei sehr geringen Einsatzkosten.

Der Vortrag gibt einen Überblick über die wissenschaftlichen Anforderungen und technischen Spezifikationen solcher UAV. Verschiedene Messtechnik wird vorgestellt und Ergebnisse einiger Messkampagnen werden erläutert. Im Ausblick werden Projekte der nahen Zukunft skizziert. Insbesondere die Anwendung von UAV in der Windenergieforschung wird erörtert.

Kaffeepause

UP 3.2 Wed 17:45 G/gHS

BrO/SO_2 emission ratios from four "NOVAC" volcanoes — •F. Dinger[1], P. Lübcke[1], S. Warnach[1], N. Bobrowski[1], L. Vogel[1,7], U. Platt[1], T. Wagner[2], S. Arellano[3], B. Galle[3], G. Garzon[4], S. Hildago[5], and M. Yalire[6] — [1]IUP, University of Heidelberg, Germany — [2]MPIC, Mainz, Germany — [3]Chalmers University of Technology, Gothenburg, Sweden — [4]SGC, Cali, Colombia — [5]IGEPN, Quito, Ecuador — [6]OVG, D.R. Congo — [7]now at University of Leicester, UK

Volcanic gas emissions often correlate with changes in the volcanic system. The total amount and the chemical composition of gas emissions help to understand the volcanic system and thus allow to improve forecasts of volcanic activity. BrO/SO_2 ratios can be obtained by remote-sensing Differential Optical Absorption Spectroscopy (DOAS). The Network for Observation of Volcanic and Atmospheric Change (NOVAC) has installed 80 scanning DOAS instruments at 30 volcanoes world wide. The instruments monitor volcanic emissions by measuring scattered solar radiation. SO_2 emissions are continuously monitored and transmitted to the observatories. While the retrieval of volcanic SO_2 emissions from NOVAC data is well developed, the retrieval of volcanic halogen emissions is more challenging due to the lower amount and therefore lower optical densities. This work will focus on an overview of the currently evaluated data, discuss the results, and investigate the BrO/SO_2 ratio in volcanic emissions as a potential proxy for the magma depth. We will show examples from Nyiragongo (Congo), Tungurahua (Ecuador), Nevado del Ruiz and Galeras (Colombia).

UP 3.3 Wed 18:00 G/gHS

A Fabry-Perot interferometer-based Camera for SO_2 detection — •Jonas Kuhn[1], Nicole Bobrowski[1], Peter Lübcke[1], Denis Pöhler[1], Jan-Lukas Tirpitz[1], Leif Vogel[2], and Ulrich Platt[1] — [1]Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany — [2]Earth Observation Science, Space Research Centre, University of Leicester, Leicester, UK

The SO_2 camera is becoming an established tool for measuring two-dimensional SO_2 column density distributions at volcanoes with a high temporal resolution. Transport and dilution processes are visualized and SO_2 emission fluxes can be determined on a very short timescale. However, these major advantages go together with a simplified identification principle that is far less accurate than conventional remote sensing trace gas measurements with only one viewing direction. By using a Fabry-Perot interferometer in a new camera design, the SO_2 selectivity and sensitivity can be improved substantially. We present first laboratory measurements of a one pixel prototype of a Fabry-Perot interferometer-based SO_2 camera. In addition, different possible implementations of an imaging device are proposed.

UP 3.4 Wed 18:15 G/gHS

Scanning lidar measurements of water vapor and temperature in the atmospheric boundary layer — •Florian Späth, Eva Hammann, Shravan Kumar Muppa, Simon Metzendorf, Andrea Riede, Andreas Behrendt, and Volker Wulfmeyer — University of Hohenheim, Institute of Physics and Meteorology, Garbenstr. 30, 70599 Stuttgart, Germany

The University of Hohenheim has developed and operates two unique high-resolution scanning lidar systems. One system uses the differential absorption lidar (DIAL) technique to determine atmospheric water vapor content. The other system is a rotational Raman lidar (RRL) with the focus of measuring temperature. These two systems were employed within the surface-atmosphere-boundary-layer exchange (SABLE) field campaign near Pforzheim (southwest Germany) in summer 2014. The goal of the campaign was to collect a new data set on the exchange processes of the surface and the vegetation with the boundary layer. For this, synchronized scanning measurements of the water vapor DIAL and the temperature RRL were performed for the first time. Additional vertical measurements were performed to analyze the entrainment processes between boundary layer and free troposphere.

The new set-ups of the two Hohenheim lidars and first results of lidar measurements during the SABLE campaign will be presented at the conference.

UP 3.5 Wed 18:30 G/gHS

D/H Isotope Ratio Measurements of Atmospheric Volatile Organic Compounds — •Thomas Meisehen, Fred Bühler, Ralf Koppmann, and Marc Krebsbach — Institute for Atmospheric and Environmental Research, University of Wuppertal

Analysis of isotope ratios in volatile organic compounds (VOC) is a reliable method to allocate their sources, to estimate atmospheric residence times and investigate physical and chemical processes on various temporal and spatial scales. Most investigations yet focus on carbon isotope ratios. However, more detailed information can be gained by the ratio of deuterium (D) to hydrogen (H) in VOC, especially due to the high mass ratio.

We thoroughly set up and characterized a gas chromatograph pyrolysis isotope ratio mass spectrometer to measure the D/H ratios in atmospheric VOC. From about 200 L of air VOC were absorbed on Tenax®TA to remove atmospheric CO_2. Our results show that the pyrolysis method has a significant impact on the D/H ratios. A pyrolysis temperature of at least 1723 K and conditioning of the ceramic tube on a regular basis is essential to obtain reproducible D/H isotope ratios. D/H ratios of the pure VOC used for a custom made gas standard mixture were determined independently by elemental analysis. Comparison of the results shows a good agreement. We further demonstrate the stability of our system and show that the sample preparation does not affect the isotope ratios. Combining measurements of carbon and hydrogen isotopes could lead to considerable improvement in our understanding of atmospheric processes in the future.

UP 3.6 Wed 18:45 G/gHS

A Compact Longpath DOAS — •Nikolai Riedel, Denis Poehler, Stefan Schmitt, and Ulrich Platt — Institute of Environmental Physics, University of Heidelberg, Heidelberg, Germany

Longpath DOAS systems are well established and used in high sensitive measurements of trace gases in the atmosphere. Using active light sources trace gases can be measured independent of the sun. In the past these systems were dependent on electrical infrastructure and regular adjustment by experienced operators and thus had only a limited application. Based on an earlier prototype we developed a mobile *Longpath DOAS* instrument, which can perform autonomous measurements. The instrument is a low power system using different LED's (315, 340 and 450 nm central wavelength) as light sources. Trace gases such as pollutants like NO_2, O_3, SO_2, $HCHO$ and $HONO$ can be measured as well as the halogen compounds ClO, BrO and IO. We

present the developed system and first example measurements.

UP 3.7 Wed 19:00 G/gHS

Ground based in-situ measurements of snow fall with a 2D-Video Disdrometer on Mt. Zugspitze, Germany — •Felix Bernauer[1], Martin Schwinzerl[2], Kerstin Hürkamp[1], Werner Rühm[1] und Jochen Tschiersch[1] — [1]Institute of Radiation Protection, Helmholtz Zentrum Muenchen, 85764 Neuherberg, Germany — [2]Joanneum Research, 8010 Graz Austria

The measurement of micro physical properties of snow fall is a challenging task that is essential in many areas of research e. g. wet deposition of atmospheric pollution. In this contribution we analyze the suitability of a 2D-video-disdrometer (2DVD by Joanneum Research) to measure shape parameters of solid precipitation and present a simple and reproducible method for precipitation event classification with a focus on solid type precipitation. For our study we installed the 2DVD at a high alpine site in southern Germany (the Environmental Research Station Schneefernerhaus (UFS) on Mt. Zugspitze, 2650m a.s.l.). A very important prerequisite for our results is to introduce a new matching algorithm suitable for solid and mixed phase hydrometeors which allows classification without artifacts. An experiment with steel spheres in a size range from 0.5mm to 10.0mm showed that simple geometries can be represented very well with shape parameters measured with the 2DVD. Analysis of 40 snow fall events and comparison with man made observations showed that solid type precipitation can be reliably differentiated in three classes of dominating hydrometeor types and three classes of riming. Addidionaly liquid and mixed phase precipitation can be classified.