UP 1: Atmosphere - Trace Gases

Time: Tuesday 10:05–13:15 Location: H41

Begrüßung und Eröffnung (10:05 - 10:15)

Invited Talk UP 1.1 Tue 10:15 H41

Observations of tropospheric NO2 at different scales — •Andreas Richter, Andreas Hilboll, Andreas C. Meier, Anja Schönhardt, Stefan F. Schreier, Enno Peters, Folkard Wittrock, and John P. Burrows — Institut für Umweltphysik, Universität Bremen, Deutschland

Nitrogen oxides are important players in the chemistry of the atmosphere, both in the troposphere and the stratosphere. As they are emitted by many anthropogenic activities, they are often used as tracer of pollution. Having a short atmospheric life time, nitrogen oxides are mainly found close to their sources.

Nitrogen dioxide can be measured by UV/visible remote sensing from satellite, aircraft and from the ground. These different measurements average over different temporal and spatial scales, leading to different but complimentary views of the distribution of NO_2 in the polluted troposphere. Comparing and combining these data sources provides unique information on the variability of this species and what is needed for an observing system to obtain appropriate measurements to understand the behaviour of NO_2 in the troposphere.

In this presentation, satellite data from GOME2 and OMI will be linked to airborne high resolution NO_2 maps from the AirMap instrument, ground-based MAX-DOAS observations at multiple azimuth angles and car-DOAS measurements, all in polluted locations.

UP 1.2 Tue 10:45 H41

Variations of the BrO/SO_2 molar ratios during the 2015 Cotopaxi eruption — •F. Dinger[1,2], S. Arellano[3], J. Battaglia[4], N. Bobrowski[2,5], B. Galle[3], S. Hernandez[6], S. Hidalgo[6], C. Hörmann[1], P. Lübcke[2], U. Platt[2], M. Ruiz[6], S. Warnach[2], and T. Wagner[1,2] — [1]MPIC, Mainz, Germany — [2]IUP, University of Heidelberg, Germany — [3]Chalmers University of Technology, Gothenburg, Sweden — [4]LMV, Université Blaise Pascal-CNRS-IRD, France — [5]University of Mainz, Germany — [6]IGEPN, Quito, Ecuador

Cotopaxi volcano is located 50 km south of Quito, the capital of Ecuador. After almost 140 years of relative quiescence, increasing activity is observed in seismicity and gas emissions since May 2015. Since 2009 Cotopaxi volcano is part of the Network for Observation of Volcanic and Atmospheric Change (NOVAC) which regularly monitors the SO_2 emissions of more than 30 volcanoes using scanning UV-spectrometers. The interpretation of SO_2 emissions can be improved by additionally recording halogen/sulphur emission ratios. Recently, it has been shown that spectra from NOVAC instruments can also be used to retrieve the BrO/SO_2 molar ratio by applying Differential Optical Absorption Spectroscopy (DOAS). We apply DOAS to analyse the plume composition of Cotopaxi volcano and will present time series of the BrO/SO_2 molar ratios as monitored by the ground-based NOVAC instruments since March 2015. Prior to the phreatic explosions in August 2015 the BrO signal was below the detection limit. Soon after the explosions the BrO/SO_2 molar ratio was low as $1 \cdot 10^{-5}$, but during September-December 2015 this ratio varies between $3 - 11 \cdot 10^{-5}$.

Kaffeepause (30 min)

UP 1.3 Tue 11:30 H41

Effect of the solar proton events on the OH Meinel emission altitude and variability in Hydroxyl airglow during the last solar cycle retrieved from SCIAMACHY nightglow observations — •Georg Teiser[1], Christian von Savigny[1], and Holger Winkler[2] — [1]Institute of Physics, Ernst-Moritz-Arndt-Universität Greifswald — [2]Institute of Environmental Physics, University of Bremen

Airglow observations are a fundamental tool to study the Earth's mesosphere. Today there is a network of ground-based instruments at locations distributed all over the world to observe the night time hydroxyl airglow in the mesopause region. In particular the emission of chemically excited OH molecules is used to derive the kinetic temperature in the height of ~87 km. In this context the knowledge of the spatial and temporal variability of the OH nightglow emission is of importance for the interpretation of ground-based OH temperature measurements. The OH nightglow data set from SCIAMACHY on Envisat (from August 2002 to April 2012) is analyzed for 11-year solar cycle signatures and short-term variability, e.g. solar-driven 27-day cycle and QBO signatures in vertical volume emission rate profiles and mean emission altitude of the OH(3-1) and OH(6-2) Meinel emission. Additionally, the effect of precipitating solar protons on the OH Meinel emission rate and emission altitude caused by ion-chemical processes is presented. SCIAMACHY measurements cover all major SPEs in the years 2003 to 2011. The observations are compared with simulations using the UBIC (University of Bremen Ion Chemistry) model.

UP 1.4 Tue 11:45 H41

Airglow von angeregten O2- und OH-Molekülen: Vergleich des Globalmodells EMAC mit SCIAMACHY Beobachtungen — •Stefan Versick[1], Stefan Bender[1], Christian von Savigny[2], Miriam Sinnhuber[1], Georg Teiser[2], Alexey Vlasov[1] und Amirmahdi Zarboo[1] — [1]Karlsruher Institut für Technologie, Deutschland — [2]Ernst-Moritz-Arndt-University Greifswald, Deutschland

Bei Airglow handelt es sich um eine schwache Leuchterscheinung in den oberen Schichten der Atmosphäre. Er wird durch verschiedene photochemische Prozesse verursacht. Airglow kann genutzt werden um Mischungsverhältnisse verschiedener Spurenstoffe zu bestimmen, um dynamische Phänomene zu untersuchen, oder um chemische Heizraten zu bestimmen. Hier konzentrieren wir uns auf den durch Chemolumineszenz und Photodissoziation von O3 angeregten Airglow von O2- und OH-Molekülen.

Für die gezeigten Vergleiche nutzen wir die neu entwickelte vertikal erweiterte EMAC-Version und um die relevanten Prozesse für Airglow erweitert wurde. Das online-gekoppelte Chemiemodell MECCA berechnet hieraus die Übergänge der angeregten OH-Moleküle. Dieser Vortrag konzentriert sich auf den OH(3-1) Übergang bei einer Wellenlänge von 1540 nm. Wir vergleichen die Modellergebnisse mit SCIAMACHY-Beobachtungen.

EMAC wurde ebenfalls um den Airglow von zwei angeregten Zuständen des molekularen Sauerstoffs erweitert: O2($^1\Delta$) bei 1270nm und O2($^1\Sigma$) bei 762nm. Wir zeigen Vergleiche mit den Ergebnissen des neuen Retrievals der 762nm-Bande aus SCIAMACHY-Beobachtungen.

UP 1.5 Tue 12:00 H41

First retrievals of Na profiles in the mesopause region based on Na nightglow observations — •Christian von Savigny, Bianca Zilker, and Martin Langowski — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald

The Na D lines are a well known feature of the terrestrial airglow and have been identified for the first time in 1929. During the daytime the Na airglow emission is caused by resonance fluorescence, while during the night the excitation occurs by chemiluminescent reactions. Knowledge of Na in the mesopause region is of interest, because the Na layer is thought to be maintained by meteoric ablation and Na measurements allow constraining the meteoric mass influx into the Earth system. In this contribution we employ SCIAMACHY/Envisat nighttime limb measurements of the Na D-line airglow from fall 2002 to spring 2012 - in combination with photochemical models - in order to retrieve Na concentration profiles in the 75 - 100 km altitude range. The Na profiles show realistic peak altitudes, number densities and seasonal variations. The retrieval scheme, sample results and comparisons to ground-based LIDAR measurements of Na as well as SCIAMACHY daytime retrievals will be presented. Moreover, uncertainties in the assumed photochemical scheme and their impact on the Na retrievals will be discussed.

Mittagspause (12:15 - 13:15)