AGENDA

IUP-AWI Block seminar online

Current research topics in Atmospheric Chemistry and Physics

Date Monday 22nd February 2021

1) 09:00 - 09:20
   John P. Burrows

Session 1: Upper atmospheric research

2) 09:20 - 09:40 The hydroxyl airglow layer, rotational temperatures, and (non-)LTE
   Holger Winkler

3) 09:40 - 10:00 Recent extreme events in polar stratospheric ozone
   Mark Weber

4) 10:00 - 10:20 Stratospheric ozone profiling and trends
   Carlo Arosio

5) 10:20 - 10:40 Using space borne observations of the scattered solar light in a limb viewing geometry to investigate stratospheric aerosols
   Alexei Rozanov

10:40 - 11:00 Coffee Tea Break

Session 2: lower Atmospheric Tropospheric Research

6) 11:00 - 11:20 First results from the S5P-Ruhr-2020 validation campaign
   Kezia Lange

7) 11:20 - 11:40 Tephra Transport Modelling: Why, how and when
   Alex Poulidis

8) 11:40 - 12:00 Observations in the outflow of major population centres during the EMeRGe European intensive operational period in summer 2017
   Maria Dolores Andrés Hernández

9) 12:00 - 12:20 How do CAMS simulations compare to measurements during EMeRGe in Europe?
   Anne Blechschmidt

12:20 - 13:10 Lunch break

10) 13:10 - 13:30 Overview of XBAER algorithm: current status and future perspective
    Linlu Mei

11) 13:30 - 13:50 The VTOL project: How to measure ship emissions using UAVs?
    Folkard Wittrock

12) 13:50 - 14:10 Ship-borne MAX-DOAS measurements in North and Baltic sea
    André Seyler

13) 14:10 - 14:30 Ozone in the free troposphere during the COVID-19 pandemic
    Wolfgang Steinbrecht

14:30 - 15:00 Coffee tea break

14) 15:00 - 15:30 Storylines of future meteorological extremes
    Thomas Jung

15) 15:30 - 16:00 Human driven changes in atmospheric deposition of nitrogen to ecosystems.
    Maria Kanakidou

16) 16:00 - 16:20 The role of termite emission in the CH_4 budget
    Hella van Asperen

17) 16:20 - 16:40 Satellite observations of atmospheric methane with Sentinel 5 Precursor
    Oliver Schneising

18) 16:40 - 17:00 Remote sensing of Greenhouse gases at the point source scale - airborne and satellite perspectives
    Heinrich Bovensmann

ABSTRACTS

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Current research topics in Atmospheric Chemistry and Physics

Date Monday 22nd February 2021

The hydroxyl airglow layer, rotational temperatures, and (non-)LTE

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There is a layer of vibrationally excited hydroxyl molecules (OH*) in the mesopause region. One of the standard methods to remotely sense the temperature of the mesopause region is based on spectroscopic measurements of near-infrared emissions of ro-vibrational transitions of OH*, and to calculate rotational temperatures. For the interpretation of the retrieved temperatures, the aspect of rotational thermalization is of great importance. We present results of a first-principle kinetic model of vibrationally-rotationally excited hydroxyl molecules. The model simulations reproduce the observed bimodality in temperatures, i.e. a cold temperature component dominating the population of low rotational states, and a hot temperature component dominating higher states. The model results are compared to measurement data from the astronomical observatory at Cerro Paranal in Chile which allows us to confine free model parameters such as the rotational state changes in a vibrational quenching process.

Recent extreme events in polar stratospheric ozone

Mark Weber - IUP

In this presentation we will try to put extreme events we have seen in Arctic and Antarctic ozone very recently in context with expected long-term changes in ozone due the Montreal Protocol phasing out ozone-depleting substances and to climate change.

Stratospheric ozone profiling and trends

Carlo Arosio - IUP

The stratospheric ozone layer suffered a significant decline at the end of the 20th century as a consequence of anthropogenic emissions of halogenated substances. An ozone recovery has been predicted for the current century in response to the actions taken with the Montreal Protocol and amendments. The onset of this recovery has been detected over the last decade and analyzed using satellite measurements. The observed ozone changes show a complex structure as a function of altitude and latitude, which is related to the interplay between atmospheric transport and chemistry, both affected by climate change.

Limb observations are an optimal tool to globally monitor the vertically-resolved composition of the stratosphere at high temporal and spatial resolution. While some limb-viewing NASA instruments are still in operation, no ESA limb sensors are currently operating.

In this talk, an overview of the current global ozone status will be introduced, together with an update of the status of the retrieval of ozone profiles from the NASA OMPS - Limb Profiler. This instrument was launched in 2012 and is contributing to the monitoring of the ozone layer. Improvements in the lower stratosphere and in the polar regions have been recently achieved. Stratospheric ozone trends will also be shown, by using the merged SCIAMACHY - OMPS data set, which covers the period 2002-2020.

Using space borne observations of the scattered solar light in a limb viewing geometry to investigate stratospheric aerosols

A. Rozanov, E. Malinina-Rieger, C. Arosio, C. Pohl, and J. P. Burrows - IUP

Stratospheric aerosols play an important role in the Earth system and in the climate. Through the scattering of solar radiation back to space and by heating the stratosphere through the absorption of thermal infrared radiation upwelling from the troposphere, stratospheric aerosols impact the radiative forcing and thus the energy balance of the Earth's atmosphere. By providing a surface for heterogeneous reactions, which release halogens, stratospheric aerosols contribute to the catalytic depletion of ozone. Because of a strong coupling between the stratospheric aerosols, stratospheric ozone amount, and thermal balance and dynamics of the atmosphere, it is essential to consider realistic aerosol information in modelling studies and in the interpretation of measurements related to the stratosphere.

The only source of the vertically resolved information on the stratospheric aerosol on the global scale is provided by space borne observations in visible, near-IR (NIR) or thermal-IR (TIR) spectral ranges. With exception of the LIDAR instruments only measurements in limb and occultation viewing geometry are capable to provide highly vertically resolved stratospheric aerosol information. In this presentation we focus on the limb measurements in visible-NIR spectral range performed by SCIAMACHY/Envisat and OMPS-LP/Soumi-NPP instruments.

Aerosol extinction coefficient is widely used to describe the amount of stratospheric aerosol. This quantity is wavelength dependent and usually provided a one or several wavelengths. At a first approximation the aerosol extinction coefficient can be used to estimate the radiative forcing and thus quantify the implications for ozone and climate change. A characteristic of the wavelength behavior of the aerosol extinction coefficient is provided by the Angstrom exponent. A more comprehensive information about the stratospheric aerosols is given by their particle size distribution parameters.

In this presentation we discuss the methods to observe and to retrieve different characteristics of the stratospheric aerosols and discuss their advantages and disadvantages. The results obtained at IUP Bremen are compared to other measurements and model simulations, some cases studies demonstrating a practical use of the results are discussed.

Tephra Transport Modelling: Why, how and when

Alex Poulidis - IUP

Volcanic eruptions release tephra into the atmosphere, creating a hazard that affects lives, livelihoods and infrastructure across borders. The presentation will cover the basics of tephra transport modelling and introduce state-of-the-art research on the study of small-scale eruptions.

Observations in the outflow of major population centres during the EMeRGe European intensive operational period in summer 2017

Maria Dolores Andrés Hernández - IUP

EMeRGe (**E**ffect of **Me**gacities on the transport and transformation of pollutants on the **R**egional and **G**lobal scal**e**s) is an international project focusing on atmospheric chemistry, dynamics and transport of local and regional pollution originating in megacities and other major population centres (MPCs). Airborne measurements taking advantage of the long range capabilities of the HALO research platform (High Altitude and LOng range research aircraft, www.halo-spp.de) are a central part of the research project. In order to provide an adequate set of measurements at different spatial scales, two field experiments were positioned in time and space to contrast situations when the photochemical transformation of plumes emerging from MPCs is large. The intensive observational periods (IOP) involved HALO airborne measurements of ozone and its precursors, volatile organic compounds, aerosol particles and related species as well as coordinated ground-based ancillary observations at different sites. Perfluorocarbon (PFC) tracer releases, satellite observations and model forecasts supported the flight planning and the identification of pollution plumes.

This talk will report about the experimental deployment of the IOP conducted in July 2017 over Europe and the results from 7 HALO research flights with aircraft base in Germany. The MPC targets London, Benelux/Ruhr, Paris, Rome and Po Valley, Madrid and Barcelona were investigated. An overview of the most salient results and scientific questions in the European context will be provided.

How do CAMS simulations compare to measurements during EMeRGe in Europe?

A.-M. Blechschmidt[1], H. Huntrieser[2], R. Baumann[2], D. Sauer[2], H. Schlager[2], H. Ziereis[2], J. Schmidt[3], E. Förster[4], Andreas Zahn[4], Florian Obersteiner[4], J. Schneider[5], Bruna Holanda[5], Katharina Kaiser[5], Ovid Krueger[5], J. Flemming[6], M. D. Andrés Hernández[1] and J. P. Burrows[1]

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The **E**ffect of **Me**gacities on the Transport and Transformation of Pollutants on the **R**egional to **G**lobal Scal**e**s (EMeRGe) aircraft campaign over Europe took place in July 2017. It was aimed at improving the understanding and prediction of the transport and transformation of pollution plumes from European major population centers. The campaign was supported by atmospheric chemistry and tailor-made tracer simulations by the Copernicus Atmosphere Monitoring Service (CAMS) for flight planning. In this talk, the pollution transport patterns as predicted by the CAMS forecasts will be analysed and compared to the measurements by the **H**igh **A**ltitude and **Lo**ng Range (HALO) research aircraft.

Ozone in the free troposphere during the COVID-19 pandemic

Wolfgang Steinbrecht - DWD

In spring and summer 2020, stations in the northern extratropics report on average 7% (4 ppb) less tropospheric ozone than normal. Such low tropospheric ozone, over several months, and at so many sites, has not been observed in any previous year since at least 2000. Most of the reduction in tropospheric ozone in 2020 is likely due to emission reductions related to the COVID-19 pandemic.

Storylines of future meteorological extremes

Thomas Jung - AWI

Novel storyline scenarios for recent extreme events, such as the heat wave in summer 2018 and wind storms will be explored. The scenarios will be carried out with the AWI Climate Model by imposing the observed development of the large-scale atmospheric circulation, e.g. the jet stream and other structures, during the course of the integration by employing a scale-dependent spectral nudging approach—thereby separating dynamical from thermodynamic changes in the model. Furthermore, increased greenhouse gas concentrations, higher ocean temperatures and adjusted vegetation will be used to illustrate how recent extreme events and their impacts (e.g., on hydrology and rivers) would unfold in 2030, 2050 and 2100 for pathways in to 1.5°C, 2°C and 4°C warmer worlds. Focussing on scenarios for recent extreme events, that are fresh to people's memory, facilitates understanding of climate change and thus adaptation

First results from the S5P-Ruhr-2020 validation campaign

Kezia Lange - IUP

Airborne imaging DOAS and ground-based stationary and mobile DOAS measurements were conducted during the S5P-VAL-DE-Ruhr campaign in September 2020 in the Ruhr area. The measurements are used to validate data from the Sentinel-5P TROPOspheric Monitoring Instrument (TROPOMI) with focus on the NO_2 tropospheric vertical column product. Here we present first results and give an overview of the acquired dataset.

The role of termite emission in the CH_4 budget

Hella van Asperen - IUP

The magnitude of termite CH4 (methane) emissions is still an uncertain part of the global CH4 budget. In this presentation, we present how current (global) termite CH4 emissions are estimated. In addition, we present results from a field experiment performed in the Amazon rain forest, where emissions from termites and termite nests were measured.

John Philip Burrows is inviting you to a scheduled Zoom meeting.

Topic: IUP AWI Block Seminar: Part 1

Time: Feb 22, 2021 08:30 AM Amsterdam, Berlin, Rome, Stockholm, Vienna

Join Zoom Meeting

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