EP 2 CAWSES

Zeit: Freitag 14:00–18:45 Raum: TU BH349

Hauptvortrag EP 2.1 Fr 14:00 TU BH349

Climate and Weather of the Sun-Earth System (CAWSES) — •Franz-Josef Lübken — Leibniz-Institut für Atmosphärenphysik, Schloss-Str.6, 18225 Kühlungsborn

SCOSTEP (Scientific Committee on Solar Terrestrial Physics) hat für die Jahre 2004 bis 2008 ein neues, internationales Programm mit der Bezeichnung CAWSES ins Leben gerufen. Im Rahmen dieses Programms werden Wissenschaftler weltweit in koordinierten Projekten das Gesamtsystem Sonne/Erde untersuchen. Ziel des Programms ist ein besseres Verständnis des Einflusses der Sonne auf die Erdatmosphäre auf Zeitskalen von Stunden bis Jahrhunderten. Die Sonne modifiziert die Atmosphäre durch die Absorption von Strahlung und Teilchen, durch die Erzeugung und Veränderung von photochemisch relevanten Spurengasen, sowie durch die Anregung von Wellen. Durch verschiedenartige Kopplungsprozesse, wie z. B. durch den Transport von Spurengasen, kann eine lokale Störung bis in große Entfernungen transportiert werden. Die Variationen der solaren Aktivität sind auch zur Einschätzung des anthropogenen Klimatrends von Bedeutung. Die DFG hat ein neues Schwerpunktprogramm zu diesem Thema eingerichtet. Im Vortrag wird CAWSES vorgestellt und die wichtigsten Ziele des neuen Schwerpunktprogramms erläutert. Am Beispiel von Eisschichten in der oberen Atmosphäre wird der Einfluss der Sonne auf die Erdatmosphäre vorgestellt.

Fachvortrag EP 2.2 Fr 14:30 TU BH349

Energiereiche Teilchen als ein Mittler zwischen Sonne und Atmosphäre!? — •May-Britt Kallenrode — FB Physik, Universität Osnabrück, Barbarastr. 7, 49069 Osnabrück, mkallenr@uos.de

Energiereiche Teilchen geladene stammen aus unterschiedlichen Quellen, z.B. kosmische Strahlung, Flares oder Polarlicht. Sie alle haben bestimmte Spektren, ihre Intensitäten werden mit der solaren Aktivität moduliert. Und alle ionisieren die Atmosphäre. Konsequenzen sind sichtbar (Polarlichter), messbar (Ozonabbau nach großen solaren Ereignissen) oder spekulativ (Wolken und kosmische Strahlung). Diese Prozesse werden im Vortrag kurz angerissen, der Schwerpunkt wird auf dem Zusammenhang zwischen solaren energiereichen Teilchen und Ozon liegen auf Zeitskalen von Einzelereignissen bis hin zu Solarzyklen. Auch die Einflüsse der Variation solarer Aktivität auf längeren Zeitskalen und des veränderlichen geomagnetischen Feldes werden angesprochen.

Fachvortrag EP 2.3 Fr 14:50 TU BH349

Solar irradiance variations on time scales of interest for climate studies — •Natalie Krivova — Max-Planck-Institut fuer Sonnensystemforschung, Max-Planck-Str. 2, 37191 Katlenburg-Lindau

Variations of solar total and spectral irradiance are reckoned key solar factors exerting influence on the Earth's climate. The time series of direct measurements of solar irradiance covers less than 3 solar cycles and is too short to understand the connection between the irradiance variability and climate change. Therefore it needs to be extended back in time with the help of models. This includes 2 major steps: (1) identification of the causes of the observed irradiance variations and (2) reconstruction of irradiance over as long time scales as possible. Here a brief overview of recent efforts to model solar total and spectral irradiance variations on time scales of relevance for climate studies is given.

Fachvortrag EP 2.4 Fr 15:10 TU BH349

Modelling 11-Year Solar Cycle Variations in the Stratosphere — •Ulrike Langematz[1], Katja Matthes[2], and J. Lee Grenfell[3] — [1]Institut für Meteorologie, Freie Universität Berlin — [2]National Center for Atmospheric Research, USA — [3]DLR Institut für Verkehrsforschung, Berlin

The impact of 11-year solar cycle variations in the stratosphere has been studied in various general circulation models using spectral solar insolation and modified ozone climatologies for solar maximum and solar minimum conditions. An ensemble analysis of these studies revealed a consistent positive temperature signal of the upper stratosphere at low latitudes for solar maximum conditions, but also large seasonal and latitudinal differences between the models, particulary in northern winter. The simulated responses were generally weaker than those derived from observational data. Due to recent developments of climate-chemistry models, new simulations of the 11-year solar cycle were able to consider directly the ozone response to the solar irradiance changes by photochemical and transport processes.

The purpose of this talk is to give an overview of the current status of modelling the effects of the 11-year solar cycle in the Earth's atmosphere. This will include new aspects to be considered in the future, e.g., the impact of 11-year variations in solar particle precipitation and the solar signal in the troposphere.

Fachvortrag EP 2.5 Fr 15:30 TU BH349

Modeling the sun's influence on climate — •Ulrich Cubasch[1], Eduardo Zorita[2], and Frank Kaspar[3] — [1]Meteorologisches Institut der Freien Universität Berlin — [2]GKSS Forschungsanstalt Geesthacht — [3]Max-Planck-Institut für Meteorologie, Hamburg

The sun influences the climate in two ways: a) by varying strength and b) by changes of the orbital parameters of the earth around the sun. The first effect currently has drawn a lot of attention, as it is considered as on candidate to be responsible for the recently observed global warming. This effect has been studied in a number of experiments simulating the recent centuries before and during industrialization. The model simulates during the Late Maunder Minimum warming rates comparable to the ones observed at present. However, the warming observed recently cannot solely be attributed to changes in solar forcing. The orbital parameters take effect in more geological timescales. Here the interest focuses on the questions like the recent ice ages and warm periods as well as the transitions between ice ages and warm periods. A simulation for 125 ky bp, which was the last warm period (Eem) as well as for 115 ky bp, i. e. the transition between warm period and ice age will be presented. The simulation of the Eemian compares well with pollen derived proxy data, and the simulation of the 115 ky bp climate shows the built up of an ice sheet in the northern part of North America.

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Diskussion — • —

EP 2.7 Fr 16:30 TU BH349

SABER and GPS, the prospective of continuous global gravity wave data from solar max to solar min — •Peter Preusse[1], Jens Wickert[2], Manfred Ern[1], and Christoph Jacobi[3] — [1]ICG-I, Forschungszentrum Juelich, 52425 Juelich, Germany — [2]GeoForschungsZentrum Potsdam (GFZ), 14473 Potsdam, Germany — [3]LIM, University of Leipzig, 04103 Leipzig, Germany

SABER satellite data are analyzed for gravity waves (GWs) up to 90 km altitude. GW distributions for Aug 2003 agree in their salient features with previous measurements from CLAES (Aug 1993) and CRISTA-2 (Aug 1997). All three data sets show convectively generated GWs in the NH subtropics and a strong maximum in the southern polar vortex (PV), which tilts equatorward around 70km altitude where the PV merges with a subtropical mesospheric jet. SABER data contain GWs with vertical wavelengths >2km. Even shorter wavelengths are addressable by novel retrieval techniques for GPS radio occultations (RO). GPS RO will particularly bring new insight on the saturated part of the GW spectrum and at altitudes where infrared remote sensing is blocked by clouds. In addition, first comparisons between GPS ionospheric irregularities and SABER GW variances are shown. GPS and SABER provide continuous coverage since the last solar max and are expected to operate until the next solar min or longer. Together with supplementary GW modeling covering several solar cycles, unprecedented insight on long term variations of GWs on global scale and their interaction with e.g. planetary waves will be gained.

EP 2.8 Fr 16:45 TU BH349

Thermospheric Winds and Densities Derived from the CHAMP Satellite STAR Accelerometer — •Vance Henize, Hermann Lühr, and Wolfgang Köhler — GeoForschungsZentrum, Potsdam

Observations from the STAR accelerometer onboard the CHAMP satellite provides the opportunity to investigate thermospheric dynamics in great detail. On its near-polar, low-Earth orbit (about 400 km), it is well suited to map the air density and winds at all latitudes. Extensive work is done to ensure cross-calibration between the along-track and cross-track axes of the accelerometer, taking into account the deviation angles of the satellite flight orientation, and using the periodic signature of the corrotation winds perpendicular to the orbit as a diagnostic. Among other features, thermal winds from dayside heating and density increases in the cusp region will be presented.

EP 2.9 Fr 17:00 TU BH349

The impact of solar activity modulated galactic cosmic rays (GCR) on clouds — •Susanne Rohs[1], Gebhard Günther[1], Bernd Kärcher[2], Martina Krämer[1], Reinhold Spang[1], Pi-Huan Wang[3], and Cornelius Schiller[1] — [1]Forschungszentrum Jülich GmbH, ICG-1 (Institut für Stratosphärische Chemie), D-52425 Jülich — [2]Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institut für Physik der Atmosphäre, Postfach 1116, D-82230 Weßling — [3]STC/NASA-LaRC, MS 910, Hampton, VA 23681-2199

Since years the scientific community discusses controversially the solar activity modulated coupling between galactic cosmic rays (GCRs) and cloudiness, which by itself affects the natural climate variability. To further evaluate this GCR-cloud link we have submitted the proposal „SAtellite and model studies of GAlactic cosmic rays and Clouds modulated by solar activity“ (SAGACITY) as part of the dfg Schwerpunkt-program CAWSES. SAGACITY focus on satellite observations of cirrus clouds, both in the long-term data record of the SAGE-2 satellite experiment as well as for episodes of solar proton events and the subsequent Forbush decreases using data of the MIPAS instrument onboard ENVISAT. Additionally we plan to develop appropriate nucleation parameterisations to be implemented in the chemical transport model CLaMS for theoretical studies of the GCR-cloud link. Here, the observed correlations between GCRs and clouds and the discussed mechanism how GCRs could influence cloud microphysics will be reviewed. Further, we present our proposed activities during SAGACITY.

EP 2.10 Fr 17:15 TU BH349

Mean wind and gravity wave trends in the upper mesosphere and lower thermosphere deduced from Collm LF D1 drift measurements 1984-2003 — •Christoph Jacobi[1], Dierk Kürschner[2], and Nikolai Gavrilov[3] — [1]Institut für Meteorologie, Universität Leipzig, Stephanstr. 3, 04103 Leipzig, Germany — [2]Institut für Geophysik und Geologie, Universität Leipzig, Collm Observatory, 04779 Wermsdorf, Germany — [3]St. Petersburg State University, Atmospheric Physics Department, 1 Ul'yanovskaya Street, Petrodvorets, Saint Petersburg, 198904, Russia

Gravity wave activity and mean horizontal winds obtained from LF drift measurements on 177 kHz in the height range 85-110 km at 52.1°N, 13.2°E during 1984-2003 are presented, allowing the analysis of long-term trends, interannual and decadal variations of the upper middle atmosphere wind field. Besides a long-term increase of the westerly mean winds in the lower thermosphere, an 11-year solar cycle signal is found in the summer months, which is strongest in the mesosphere and decreasing with height. Time series of seasonal (3-monthly) mean gravity wave activity show maximum amplitudes around 1989-1991 and 2000-2002, which is concomitant with the solar activity maxima within the 11-year solar cycle, and the time intervals of increased mean wind shear on a decadal scale.

EP 2.11 Fr 17:30 TU BH349

The global signal of the 11-year sunspot cycle in the atmosphere: When do we need the QBO? — •Karin Labitzke — Institut für Meteorologie, Freie Universität Berlin

The global structure and the size of the signal of the 11-year sunspot cycle in the stratosphere and troposphere was examined in earlier studies. The correlations between the solar cycle and heights and temperatures of and at different pressure levels were mainly carried out with the whole data set and only during northern winters the years were separated according to the phase of the Quasi-Biennial Oscillation. Here, this work is expanded and it is shown that the QBO must be introduced throughout the year, because the solar signal is very different in the respective phases of the QBO, particularly over the tropics and subtropics. The structure of the solar signal in northern summer appears to indicate that the mean meridional circulations (Hadley and Brewer-Dobson Circulations) are influenced by the 11-year solar cycle, especially during the east phase of the QBO. This result may help to find the mechanism through which the solar cycle (and the connected variation of the ultraviolet radiation) can influence the atmosphere

EP 2.12 Fr 17:45 TU BH349

Model Simulations of Thermospheric NO Intrusions and Comparison with MIPAS-ENVISAT observations — •Thomas Reddmann[1], Bernd Funke[2], Thomas von Clarmann[1], Sven Gabriel[1], Wolfgang Kouker[1], Manuel Lopez-Puertas[2], Roland Ruhnke[1], Gabriele Stiller[1], and Roland Uhl[1] — [1]Inst. of Meteorology and Climate Research, Research Center and University of Karlsruhe — [2]Instituto de Astrofisica de Andalucia, Granada

The contribution of NO intrusions from the lower thermosphere into the middle atmosphere to the total NOy budget during periods of higher solar activity and their effect on ozone chemistry is still an open question. During its first two years of operations the MIPAS instrument on the ENVISAT satellite observed NO enhancements in polar winter. In addition, first results of the solar storm period in October/November 2003 also showed enhanced NO concentrations in the upper stratosphere and ozone loss subsequent to this event. The MIPAS observations therefore provide a data set through which models of the middle atmosphere can be validated in respect of downward transport inside the polar vortex and the effect on ozone chemistry can be estimated.

Here we focus on first results of a comparison of the MIPAS observations of NO, ozone and stratospheric tracers with results obtained with the middle atmosphere model KASIMA. We discuss aspects of model initialization as data assimilation and the parameterization of photolysis rates especially for NO at high solar zenith angles.

EP 2.13 Fr 18:00 TU BH349

Enhanced NOx-induced ozone loss in the Arctic middle stratosphere during the 2002/03 winter and spring. — •Paul Konopka, Jens-Uwe Grooss, Martin Kaufmann, and Rolf Müller — Forschungszentrum Jülich, ICG-I, 52425-Jülich

High resolution, 3D simulations of tracer distribution in the Arctic tratosphere during the winter and spring 2002/2003 (SOLVE2/VINTERSOL) have been conducted with the Chemical Lagrangian Model of the Stratosphere (CLaMS). CLaMS is based on a Lagrangian formulation of the tracer transportand, unlike Eulerian CTMs, considers an ensemble of air parcels on a time-dependent irregular grid that is transported by use of the 3d-trajectories. The NOx-induced ozone loss driven by the so-called summertime NOx chemistry is a well-known photolytical mechanism mainly occurring in the middle and upper tratosphere over polar regions in spring and summer. By transporting ozone in CLaMS as a passive tracer, the chemical ozone loss can be deduced as the difference between the observed (HALOE, POAM, MIPAS) and simulated ozone profiles. Our results show that at least for 2002/03 winter the column ozone loss driven by the NOx chemistry is of the same magnitude as the chlorine-induced ozone loss in the lower stratosphere. The NOx-induced ozone decline mainly occurs in high latitudes near the vortex edge, as the stratosphere undergoes a transition from a strong mixing situation in the late winter/spring, when the vortex breaks down (top-down process), to a weakly stirred situation in summer.We discuss NOx sources which are responsible for this ozone loss, in particular the amount of stratospheric NOx that can be traced back to their sources above the stratopause.

EP 2.14 Fr 18:15 TU BH349

Towards a Better Understanding of the Energy Balance in the Upper Mesosphere and Lower Thermosphere: Contributions from the ESA ENVISAT Mission — •Martin Kaufmann[1], Martin Riese[1], Sergio Gil-Lopez[2], Manuel Lopez-Puertas[2], Bernd Funke[2], Gabriele Stiller[3], Thomas von Clarmann[3], Heinrich Bovensmann[4], Pekka Verronen[5], and Anne Smith[6] — [1]Forschungszentrum Juelich, ICG-I — [2]Instituto de Astrofisica de Andalucia — [3]Forschungszentrum Karlsruhe, IMK — [4]Universitaet Bremen, IUP — [5]Finnish Meteorological Institute — [6]National Center for atmospheric research, ACD, Boulder, USA

The mesosphere and lower thermosphere is highly sensitive to external influences from the sun as well as from the atmosphere below. Its chemical and thermal balance can change significantly due to natural influences as well as due to human-induced changes.

The combination of three instruments on board of ESA's ENVISAT satellite give a unique possibility to improve our understanding of this region. MIPAS is able to measure temperature, CO_2, and ozone during day- and nighttime. GOMOS measures nighttime ozone, and the SCIAMACHY instrument yields temperature, daytime-ozone, atomic oxygen, and in combination with the other instruments atomic hydrogen.

In this talk we focus on ENVISAT datasets which are already existing in this altitude region. The retrieval of ozone from MIPAS/ENVISAT will be described. The quality of the dataset with respect to uncertainties in the retrieval scheme and the forward modeling are analyzed.

EP 2.15 Fr 18:30 TU BH349

The sensitivity of the middle and upper atmosphere to solar and anthropogenic climate forcing: Simulations with HAMMONIA
— •Hauke Schmidt, Guy P. Brasseur, and Marco A. Giorgetta — Max Planck Institute for Meteorology, Bundesstr. 53, 20146 Hamburg

The HAMMONIA general circulation and chemistry model resolves the atmosphere from the Earth's surface up to about 250 km. This newly developed model combines the 3d dynamics from the ECHAM5 model with the MOZART3 chemistry scheme. Additional parameterizations have been implemented to account for important processes in the upper atmosphere, like solar radiation in the extreme UV, the ion drag, and molecular processes.

This study concentrates on the response of dynamics and trace gases, in particular ozone and water vapor, in the mesosphere and lower thermosphere (MLT) region to solar and anthropogenic climate forcing. Results of different simulations with HAMMONIA for low and high solar activity on the one hand, and for present day and doubled CO2 concentration on the other hand are compared. The solar cycle experiments indicate e.g. an ozone increase for high solar activity of up to 25%, a temperature increase of 3 to 10 K, and a decrease in water vapor. Additionally, we address the effect of the different types of forcing on the energy budget of the MLT.