EP 1: Erdnaher Weltraum

Zeit: Montag 14:00–16:00 Raum: G.10.02 (HS 9)

Hauptvortrag EP 1.1 Mo 14:00 G.10.02 (HS 9)

Dynamical coupling of the atmosphere by gravity waves: initial results from ground based and airborne field studies — •Markus Rapp and Andreas Dörnbrack — Deutsches Zentrum für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

Gravity waves (GW) play an important role in the coupling between the troposphere and the middle atmosphere by means of momentum and energy transport. Surprisingly little is still known about the details of the GW life cycle, i.e., the processes of GW excitation, propagation and dissipation. In order to study these processes, the DLR-Institute of Atmospheric Physics (IPA) initiated the project GW-LCYCLE in which airborne observations with the DLR-Falcon are combined with meteorological balloon soundings, ground based observations by radar and lidar, and modelling. The first field campaign was conducted in the Northern Arctic in December 2013. In addition, the IPA also participated in the NSF-led DEEPWAVE campaign in June 2014 in which various US groups studied the excitation and propagation of gravity waves in the New Zealand area using research aircraft along with various ground based remote sensing instruments. In DEEPWAVE, the IPA participated again with the DLR Falcon as well as with a new portable Rayleigh lidar for probing the thermal structure of the middle atmosphere from 20 - 80 km altitude. This paper presents the initial results from airborne and ground based observations as well as corresponding model results with focus on a comparison of typical wave properties between the two observation sites in opposite hemispheres.

EP 1.2 Mo 14:30 G.10.02 (HS 9)

Thermische Struktur und Schwerewellen in der mittleren Atmosphäre über Neuseeland — •Bernd Kaifler, Natalie Kaifler, Benedikt Ehard, Andreas Dörnbrack, Sonja Gisinger und Markus Rapp — Deutsches Zentrum für Luft und Raumfahrt e.V.

Wir präsentieren Lidar-Messungen der mittleren Atmosphäre über Neuseeland. Die Messkampagne dauerte von Juni bis November 2014 und beinhaltete die Kernperiode von DEEPWAVE-NZ, einer internationalen Kampagne zur Untersuchung der Dynamik der mittleren Atmosphäre. Das Ziel ist eine umfassende Charakterisierung atmosphärischer Schwerewellen. Schwerewellen haben eine wesentliche Bedeutung für die Dynamik der Atmosphäre, jedoch gibt es sowohl bezüglich der Entstehung, der Ausbreitung als auch der Dissipation der Wellen viele offene Fragen. Mit einem Rayleigh-Lidar wurde ein umfangreicher Datensatz gewonnen, der sowohl den Winterzustand als auch den Übergang zum Sommerzustand umfasst. Wir stellen den Verlauf der Temperatur und der Schwerewellenenergie zwischen 20 und 80 km vor. Ein neuer Algorithmus zur Identifizierung von Schwerewellen wurde entwickelt, mit dem die vertikale Wellenlänge, die scheinbare Periode und die Phasengeschwindigkeit bestimmt werden. Die hohe zeitliche und räumliche Auflösung erlaubt auch die Beobachtung von Schwerewellen mit sehr kurzer Periode bis zu 10 Minuten. Wir präsentieren ausgewählte Fälle für die Anregung und Ausbreitung von Schwerewellen. Darüber hinaus werden die Lidar-Daten mit Radiosonden-Messungen ergänzt und mit Modellrechnungen von ECMWF verglichen.

EP 1.3 Mo 14:45 G.10.02 (HS 9)

The simulation of thermospheric nitrogen intrusions with the extended EMAC model. — •Alexey Vlasov and Thomas Reddman — Karlsurhe Institute of Technology

The coupling of MLT-region to the middle atmosphere is still not well described in most of state-of-the-art climate models as their upper boundary does not cover the mesopause region. This coupling is known to be important for example in the context of energetic particle precipitation and related reactive nitrogen intrusions: such intrusions have been observed to affect the ozone budget in the stratosphere and could have an impact on the earth's climate. In order to simulate these coupled processes a climate-chemistry model spanning from the ground up to the lower thermosphere is required. Here we analyse results of runs with a vertically extended version of the climate chemistry model EMAC. At the moment, it covers the altitude range from the surface up to approximately 170 km by using parameterization for MLT-relevant radiation and molecular diffusion. The particular focus is on the analysis of the Transformed Eulerian Mean circulation. The strong NOx intrusions observed after SSWs are studied in the model using tracer release experiments where tracers have been initialized at different altitudes both in thermosphere and in the middle atmosphere. The model shows cross-mesopause transport for several mid winter SSWs in the period studied in agreement with observations.

EP 1.4 Mo 15:00 G.10.02 (HS 9)

Mini neutron monitor measurements at the Neumayer III station and on the German research vessel Polarstern — •B Heber[1], D. Galsdorf[1], J. Gieseler[1], C. Herbst[1], J. Labrenz[1], C. Schwerdt[2], M. Walther[2], G. Bernade[3], R. Fuchs[3], H. Krueger[3], and H. Moraal[3] — [1]Christian-Albrechts-Universität zu Kiel — [2]Deutsches Elektronen-Synchrotron DESY, D-15738 Zeuthen — [3]Center for Space Research, North-West University, Potchefstroom 2520, South Africa

Neutron monitors (NMs) are ground-based devices to measure the variation of cosmic ray intensities. They are reliable devices but difficult to install because of their size and weight. Therefore a portable mini NM (MNM) that can be installed as an autonomous station at any location that provides suitable conditions has been developed recently. The first continuous measuring MNMs are installed at Neumayer III and the German vessel Polarstern. They are providing scientific data since October 2012 and January 2014, respectively. NM measurements are influenced by the (variable) Earth magnetic field and the atmospheric conditions. Thus in order to interpret the data a detailed knowledge of the instrument sensitivity with geomagnetic latitude (rigidity) and atmospheric pressure is essential. The rigidity dependence is determined experimentally by utilizing several latitude scans. The Polarstern was specially designed for working in the polar seas and scans usually twice a year the rigidity range below 1 GV and above 10 GV. The results of different latitude scans from October 2012 to January 2015 will be presented and discussed in the framework of a yield function.

EP 1.5 Mo 15:15 G.10.02 (HS 9)

SCIAMACHY Langzeitmessungen von NO in der Mesosphäre und unteren Thermosphäre — •Stefan Bender[1], Miriam Sinnhuber[1], John Burrows[2] und Martin Langowski[3] — [1]Karlsruhe Insitut für Technologie, Karlsruhe — [2]Institut für Umweltphysik, Universität Bremen, Bremen — [3]Institut für Physik, Ernst-Moritz-Arndt Universität, Greifswald

Geladene Teilchen des Sonnenwindes erzeugen Stickstoffmonoxid (NO) in der oberen Atmosphäre. Nach Abwärtstransport bis in die Stratosphäre beeinflusst dieses Spurengas durch chemische Reaktionen die Ozonschicht und das Klima.

Wir messen die NO-Emissionslinien in der Mesosphäre und unteren Thermosphäre (MLT, 50–150 km) mit dem Satelliteninstrument SCIAMACHY auf dem Forschungssatelliten Envisat. Aus den SCIAMACHY UV Spektren berechnen wir die NO Teilchendichte von 60 km bis 160 km.

Wir benutzen die Spektren der speziellen MLT Scans (50–150 km) und der nominellen Scans bis 90 km. So erhalten wir tägliche Messungen der NO Dichte in Höhen von 60 bis 90 km für annähernd zehn Jahre, von August 2002 bin März 2012. Anhand dieser Zeitreihe untersuchen wir den Einfluss der Sonnenaktivität auf die Erdatmosphäre. Die Zusammenhänge mit solaren und geomagnetischen Indizes, z.B. Lyman-α und Kp, erlauben es uns, Klimamodelle in dieser Hinsicht zu überprüfen und zu verbessern.

Hauptvortrag EP 1.6 Mo 15:30 G.10.02 (HS 9)

The lunar semi-diurnal tide in the terrestrial airglow — •Christian von Savigny and Olexandr Lednytskyy — Institut für Physik, Ernst-Moritz-Arndt Universität Greifswald, Greifswald, Germany

While ocean tides are a well known and well understood phenomenon, many aspects of lunar tidal signatures in the atmosphere are less well understood. Particularly in terms of lunar semi-diurnal tidal signatures in terrestrial airglow emissions the existing studies are partly contradictory and generally suffer from lack of statistical significance. In this contribution we present the first - to our best knowledge - statistically significant lunar semi-diurnal tidal signatures in several parameters of the terrestrial airglow, including OI green line emission rates, OH(3-1) emission rates, as well as OH emission altitude, atomic oxygen and

temperature in the MLT region. The data sets are all based on nightglow measurements with the SCIAMACHY instrument on the Envisat satellite that provided measurements from fall 2002 until spring 2012. Apart from the presence of statistically significant lunar tidal signatures in each parameter studied, we find a coherent relationship between the studied parameters suggesting that the observed signatures are to a large extent driven by vertical motions. Tidally driven downwelling, e.g., leads to downward transport of atomic oxygen and hence enhanced OI green line and OH emission rates, as well as a temperature increase due to adiabatic warming.