EP 2: Erdnaher Weltraum

Time: Monday 16:30–18:30 Location: DO24 1.103

Invited Talk EP 2.1 Mon 16:30 DO24 1.103

Modeling of the solar impact on the climate system — •Eugene Rozanov — PMOD/WRC and IAC ETHZ

The solar magnetic activity variations modulate both the solar spectral irradiance and energetic particle precipitation affecting the energy deposition followed by an alteration of the photolysis and heating rates in the Earth's atmosphere. Subsequent changes of the ozone and temperature distribution have an influence on the stratospheric circulation pattern. In turn, the reconfiguration of the stratospheric winds can affect the wave pattern and surface air temperature distribution. This chain of the physical processes is characterized by downward propagation and lead to the changes of the surface temperatures and the Brewer-Dobson circulation strength. The absorption of the solar visible and infrared radiation at the surface is also able to alternate the energy balance and temperature fields at the surface which can also penetrate upward influencing the atmosphere. Modeling of these processes requires application of sophisticated numerical models which include all relevant processes and their interaction. In this review talk I will discuss all involved mechanisms and their representation in the state-of-art models. Different features of the modeled atmospheric response to solar variability will be presented and compared with the observation data. The implications of the potential weakening of the solar activity in the future will be also discussed.

EP 2.2 Mon 17:00 DO24 1.103

Neutron monitor measurements on the German research vessel Polarstern * First results — •B. Heber[1], C. Schwerdt[2], M. Walter[2], G. Bernade[3], R. Fuchs[3], H. Krüger[3], and H. Moraal[3] — [1]Insititut für Experimentelle und Angewandte Physik, 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

Cosmic-ray particles provide a unique opportunity to probe the dynamic conditions in the highly variable heliosphere. The longest continuous measurements of galactic cosmic rays come from cosmogenic isotopes and from neutron monitors located at different location on Earth. Understanding the effects of energetic particles in and on the atmosphere and the environment of Earth must address their transport to Earth and their interactions with the Earth's atmosphere, including their filtering by the terrestrial magnetosphere. Since neutron monitors are integral detectors of secondary cosmic rays produced in the atmosphere, a single neutron monitor can only derive the energy spectra of the particles impinging on the Earth during latitudinal surveys. A portable neutron monitor was built at the North-West University, South Africa, and was installed on the German research vessel Polarstern. Such latitude surveys have been done before, but this vessel is better suited for this purpose than previous platforms because it traverses all the locations with geomagnetic cutoff rigidities from $\ll 1$ GV to 15 GV at least twice per year. In this contribution we present first results from the measurement campaigns.

EP 2.3 Mon 17:15 DO24 1.103

The AFIS experiment: Detecting low energetic antiprotons in a low earth orbit, using an active target detector — •Thomas Pöschl[1], Martin Losekamm[1,2], Dominic Gaisbauer[1], Daniel Greenwald[1], Alexander Hahn[1], Philipp Hauptmann[1], Igor Konorov[1], Linxin Meng[1], Stephan Paul[1], and Dieter Renker[3] — [1]Physics Department E18, Technische Universität München — [2]Institute of Astronautics, Technische Universität München — [3]Physics Department E17, Technische Universität München

Since the first observation of geomagnetically trapped antiprotons by the PAMELA experiment and the new results on the positron excess by the AMS-02 experiment, the creation and transport of antimatter in the Earth's upper atmosphere attracts more and more attention both at theoretical and experimental side. For this reason the AFIS experiment was initiated to measure the flux of low energetic antiprotons in the South Atlantic Anomaly (SAA). We developed an active target detector made from scintillating fibers connected to silicon photomultipliers which allows to detect antiprotons in the energy interval of about 30 MeV - 100 MeV. The stopping curve of incoming antiprotons (Bragg peak) and the signal of outgoing pions created from the annihilation, are used for particle identification as well as triggering.

We plan to implement this detector on a 3 unit cubesat satellite in the framework the 'Move2Warp' mission, which is carried out as a student project by the Technische Universität München. This work is supported by the Excellence Cluster 'Origin and Structure of the Universe'.

EP 2.4 Mon 17:30 DO24 1.103

Measuring the Low-Energy Cosmic Ray Spectrum with the AFIS Detector — •Martin Losekamm[1,2], Dominic Gaisbauer[1], Daniel Greenwald[1], Alexander Hahn[1], Philipp Hauptmann[1], Igor Konorov[1], Lingxin Meng[1], Stephan Paul[1], Thomas Pöschl[1], and Dieter Renker[3] — [1]Physics Department E18, Technische Universität München — [2]Institute of Astronautics, Technische Universität München — [3]Physics Department E17, Technische Universität München

High-energy cosmic rays interact with Earth's upper atmosphere and produce antiprotons, which can be trapped in Earth's magnetic field. The Antiproton Flux in Space (AFIS) Mission will measure the flux of trapped antiprotons with energies less than 100 MeV aboard the nanosatellite MOVE 2. An active-target tracking detector comprised of scintillating plastic fibers and silicon photomultipliers is already under construction at the Technische Universität München. As a precursor to the space-bound mission, a prototype version of the detector will be launched aboard a balloon from Kiruna, Sweden as part of the REXUS/BEXUS student program by the German Aerospace Center (DLR). Named AFIS-P, it will be used to measure the low-energy part of the cosmic-ray spectrum for energies less than 100 MeV-per-nucleon. Spectrometers in previous balloon missions were not sensitive in this low-energy region. Thus AFIS-P will deliver unprecedented data, while simultaneously allowing us to field-test the AFIS detector.

This project is supported by DLR and the Cluster of Excellence “Origin and Structure of the Universe”.

EP 2.5 Mon 17:45 DO24 1.103

Atmospheric Ionization Module OSnabrueck - Update — •Jan Maik Wissing and May-Britt Kallenrode — Universität Osnabrück

The Atmosperic Ionization Module OSnabrueck (AIMOS) calculates the 3D atmospheric ionization rate due to particle precipitation. Including particles of solar and magnetospheric origin AIMOS covers an altitude range from the troposphere (for protons) and mesosphere (for electrons) up to the thermosphere. The model itself is based on a Geant4 Monte-Carlo Simulation for the particle interactions and insitu particle measurements from the POES and GOES satellites. A user-friendly website allows easy adoption of the AIMOS results on a user-specific model grid.

This presentation will deal with the recent AIMOS version update (v1.6), its motives and implications. Most important aspects to meantion here: (a) applying multiple correction algorithms for the satellite data, (b) adjusting model resolution in main precipitation regions, and (c) switching internal data handling from LT to MLT.

The main differences to the earlier versions are a significant reduction of electron induced ionization rate in the mesosphere and reduced smoothing of precipitation patterns ending up in higher ionization rate in a more defined auroral zone. Where possible these changings will be verified by measurements.

EP 2.6 Mon 18:00 DO24 1.103

Solar influence on the MLT region: NOx production due to energetic particles and solar radiation — •Holger Nieder[1], Nadine Wieters[2], and Miriam Sinnhuber[1] — [1]Karlsruhe Institute of Technology, Institute for Meteorology and Climate Research — [2]University of Bremen, Institute of Environmental Physics

The chemistry in the mesosphere/lower thermosphere (MLT) region is always driven by forcing from solar radiation and energetic particles. The resulting ionisation, dissociation and excitation of the constituents lead to production of reactive species such as NOx (N, NO, NO2), directly from dissociation as well as indirectly from subsequent ionic reactions. NOx can be transported downwards and contribute to ozone depletion in polar winter.

The production rate of NOx is approximately proportional to the ionisation rate, but the coefficient depends considerably on the atmospheric background state and on the types of primary ions produced, where the latter is different for photoionisation and ionisation due to energetic particles.

The production of NOx is investigated in detail. Its implications are studied using 1d chemistry and 3d chemistry and transport models.

EP 2.7 Mon 18:15 DO24 1.103

Langzeitmessungen von NO in der Mesosphäre und Thermosphäre mit SCIAMACHY — •Stefan Bender[1], Miriam Sinnhuber[1], John Burrows[2] und Martin Langowski[2] — [1]Karlsruhe Insitut für Technologie, Karlsruhe — [2]Institut für Umweltphysik, Universität Bremen, Bremen

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 NO-Emissionen in der Mesosphäre und unteren Thermosphäre (MLT, 50–150 km) mit dem Satelliteninstrument SCIAMACHY auf dem Forschungssatelliten Envisat.

Aus den SCIAMACHY MLT UV Spektren berechnen wir die NO Teilchendichte von 60 km bis 160 km. Wir erreichen dabei eine vertikale Auflösung von 5–10 km und eine horizontale Auflösung von etwa neun Grad. Mit der Auswertung der nominellen SCIAMACHY Daten (limb scans von -3 km bis 90 km) 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. Zusammenhänge mit solaren Indizes (Lyman-α, f10.7, Kp, Ap etc.) erlauben es uns, Klimamodelle in dieser Hinsicht zu überprüfen und zu verbessern.