UN/ESA/NASA/JAXA/BAS Workshop on
"First Results from the International Heliophysical Year 2007"
Sozopol, Bulgaria, June 2 -6, 2008

BOOK of ABSTRACTS

We wish to thank the following for their contribution to the success of this workshop: ***National Science Fund of the Ministry of Education and Science***, the ***European Office of Aerospace Research and Development***, ***Air Force Office of Scientific Research, United States Air Force Research Laboratory***, and the ***Austrian Science and Research Liaison Office Sofia.***

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THE INTERNATIONAL HELIOPHYSICAL YEAR: AN UPDATE

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The International Heliophysical Year (IHY) is a program of international collaboration to address fundamental global questions of Earth and space science. The goals of the IHY are to: 1. Develop the basic science of heliophysics through cross-disciplinary studies of universal processes. 2. Determine the response of terrestrial and planetary magnetospheres and atmospheres to external drivers. 3. Promote research on the Sun-heliosphere system outward to the local interstellar medium - the new frontier. 4. Foster international scientific cooperation in the study of heliophysical phenomena now and in the future. 5. Preserve the history and legacy of the IGY on its 50th Anniversary. 6. Communicate unique IHY results to the scientific community and the general public. The IHY helps us develop a deeper understanding of physical processes in the solar system through a program of comparative study of universal processes that affect the interplanetary and terrestrial environment. The IHY goals will be achieved by addressing four key elements: Science, instrument development, history preservation, and public outreach. Science will be done based on a series of observing campaigns being developed as the Coordinated Investigation Programs (CIPs). The instrument development program is a cooperative activity between the United Nations and IHY to deploy low-cost instruments in developing nations that provide important data on space science. The history preservation is being accomplished by compiling information on scientists who worked during the famous 1957 International Geophysical Year (1957-58) and recognize them during 2007-2009. The outreach program is a worldwide effort to demonstrate the beauty of and benefit of space science to the general public. This presentation reviews the current status of worldwide IHY efforts.

OPTICAL SOLAR OBSERVING FACILITIES IN KOREA ASTRONOMY AND SPACE SCIENCE INSTITUTE (KASI)

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In this talk, we introduce optical solar observing facilities in Korea Astronomy and Space Science Institute (KASI). The KASI has three optical solar observing facilities such as solar sunspot telescope, solar flare telescope, and solar imaging spectrograph. The solar sunspot telescope (SST), which is a refractor with a diameter of 20 cm, had been installed at the Sobaek mountain and moved to Daejeon in 1987. The SST was used to observe the daily sunspot number and the white-light photosphere in order to monitor the long-term solar activity variations. The solar flare telescope (SOFT) had been installed at the top of the Bohyun mountain in 1995. The SOFT was originally designed by 4 channels for the observation of solar active regions, such as white-light and H-alpha observing systems, vector magnetograph (VMG), and longitudinal magnetograph (LMG). In 2006, H-alpha full-disk monitoring systems for the chromosphere and the corona were added to the SOFT. The KASI solar imaging spectrograph (KSIS) has been upgraded from the solar spectrograph that was able to record solar spectra for a given slit region and to inspect the response function of narrow band filters. A prototype KSIS was developed in 2004 by using a scanning mirror in front of the spectrograph slit and a CCD camera. In 2006, we have upgraded the KSIS by installing a much faster CCD camera, which gives a data acquisition time of about 5 times shorter than the prototype KSIS. Observation data from these observing facilities are used for studying solar activity and space weather.

STATUS OF AFRICA IN THE INTERNATIONAL HELIOPHYSICAL YEAR (IHY)

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The present status of Africa in the ongoing International Heliophysical Year (IHY) is presented. Historical participation of Africa in IGY is compared with the participation in IHY. Astronomical Telescopes, Atmospheric Weather Electromagnetic System for Observation Modeling and Education AWESOME, Magnetic Data Acquisition System MAGDAS, Scintillation Network Decision Aid SCINDA, AMMA GPS and IGS GPS research facilities are the IHY intervention facilities already installed in African countries. The facilities are being well utilized and coordinated. The coordination of IHY in Africa is highlighted and assessed to favour the ultimate actualization of the goals of the IHY. Four IHY-related continental workshops have been held so far in Africa with participants drawn from several African states. The African IHY summer school has been scheduled for the last quarter of 2008 in Nigeria. We describe the outreach activities across African axis during the 2006 total solar eclipse sponsored by IHY. Capacity building and technological transfer are part of the spin-off being derived from IHY. African scientists and research institutes are already benefiting from the IHY planned international collaboration and cooperation. IHY is fostering strong intra–continental partnerships amongst African scientists.

IHY AND BSS IN WEST ASIA

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This paper summarizes IHY, astronomy & space sciences (ASS) activities and their importance in many Arab countries. The level and type of these activities differ in each country. The paper shows also the current activities on topics related to IHY in different countries such as; Algeria, Egypt, Iraq, Jordan, Kuwait, Qatar, Saudi Arabia, UAE……etc

Following are suggested future BSS plans in some of these countries:

- The Gulf Observatory: An observatory of 2-3metres optical telescope proposed by astronomers from the Arabian Gulf region, to be built on top of the Jabal Shams(2,980 metres above sea level), in the Sultanate of Oman.
- The Libyan Observatory: Libya signed a contract with a French company for building an observatory of 2-metre optical robotic telescope. They are now in a process of site testing programme for three chosen mountains and training Engineers and Astronomers.
- A joint venture between Jordan, Lebanon and Syria for building 2-metre optical observatory.
- UAE Research Centre for Solar Physics, Astronomy & Space Sciences: A proposal under consideration for building a Solar Physics and Space Research Centre that may contain: Solar, radio and optical observatories, a planetarium and a BSS Museum.
- Iraqi National Astronomical Observatory (INAO): The Kurdistan Universities planning to rebuilt INAO which has been destroyed during the two wars. Proposed suggestion is to build a 5-6meters optical telescope and small solar telescope on the tope of Korek Mountain, which has excellent observing conditions.

SPACE WEATHER AND EUROPE – AN EDUCATIONAL TOOL WITH THE SUN (SWEETS)

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Space weather is defined by the conditions on the Sun and in the solar wind, the Earth's magnetosphere, ionosphere, and atmosphere. Space weather is primarily an astronomical phenomenon due to solar activity and cosmic rays and its study is by nature interdisciplinary and encompasses various fields of physics, engineering, and human activity. As such, space weather has significant impacts on our technological infrastructure, in particular on communication and navigation systems, has caused satellite failures and losses, electricity cut-offs, increases pipeline corrosion, and enhanced radiation exposure to aircraft crew and passengers and to astronauts.

Space Weather and Europe - an Education Tool with the Sun (SWEETS) is a public outreach activity. The purpose of SWEETS is to demonstrate the beauty and the significance of Sun, solar activity, and of space weather to Europe. The hazardous aspects of space weather become more and more known to decision makers and to the public. The SWEETS project thus aims to promote and raise public awareness by means of attractive and high quality deliverables.

Major activities of SWEETS are a space-weather-on-tour media bus that has been on tour in Europe, informing about origin and hazards of space weather events, organization of a web quiz on space weather, the support of local science festivals and events on space weather in Europe, organization of a science festival on space weather during the European Science Week and an European Space Weather and Earth Environment Technology Fair during November 2007, a space weather planetarium show, and production of a DVD and a film on space weather.

The outward appearance of the space-weather-on-tour media bus tells about space weather, its origin at the sun, its beauty, and its influences on Earth's environment and, in particular, the technical infrastructure in space and on ground. It contained a bi-lingual space weather poster exhibition (available in English/French, English/German, and English/Portuguese), an interactive exhibition including a video presentation of the first space weather CD-ROM, personal computers with near real time access to space weather observing satellites, an optical telescope and a radio telescope for solar observations by visitors. The tour through the bus is guided by different high-level and outreach-educated European space weather scientists.

Starting in June 2007, the space-weather-on-tour bus made its way from Greifswald via Vienna, where it stopped at the Vienna International Center during the SWEETS-supported Symposium on *Radiation Exposure to Aircraft Crew due to Space Weather Effects* and the Fiftieth session of the *Committee on the Peaceful Uses of Outer Space (COPUOS)*, to Paris, Copenhagen, Oslo, Andenes, Riga, and Kosice back to Germany. The tour further continued through Poland, Belgium, The Netherlands, Austria, and Germany, ending in Portugal during the European Science Week in November 2007.

SWEETS also organized a space weather web-based quiz with participants coming from all over Europe. The main quiz winner was been invited to Andoya Rocket Range in northern Norway in August 2007 and participated in a scientific rocket launch campaign.

SWEETS was funded by the European Commission within the 6th framework program and supported by COST actions 724 & 296 and by IHY 2007.

RESEARCH AND EDUCATION IN ASTRONOMY AND SPACE SCIENCES FOR ARAB COUNTRIES

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Astronomy and Space Sciences ASS are important fields of research, study, knowledge and culture. They have been the cradle of both eastern and western sciences.

We all know, from education and psychology, about the effective teaching and learning of ASS. Unfortunately, a small percentage of this knowledge is actually used in teaching at schools, universities level and any other academic institutions in the Arab countries. The challenge is to provide effective professional development for ASS educators and researchers at all levels, from elementary school to university.

ASS is the most appealing subject to young students and very important tool to convey scientific knowledge? Once students have understood the importance of science, they might be more easily pursued to continue their education in science and technology. The aim of this paper is to show the importance of the formal and informal ASS research, and educations, giving an example of a possible curriculum, projects, and comments of the experiences have been carried out in few Arab Countries.

We feel the need of a new communication channel among Arab people based on our common scientific ground. ASS is, in this respect, the best choice that it is possible to identify in the vast cultural heritage of the Arab basin, the final purpose is scientific and economical?

Building modern and good Observatories, Planetariums and Research Centres in the region jointly by Arab astronomers and space scientists are essential and, will be an excellent step toward developing astronomy and astrophysics (for Research, Education and Knowledge).

IHY ACTIVITIES IN EGYPT

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We present here the current status of IHY projects in Egypt. The first project is already started between Space Environment Research Center of Kyushu University in Japan and Helwan University in Egypt in order to conduct joint scientific investigations of the Earth's magnetic field. The parties will develop a network of two MAGnetic Data Acquisition Systems (MAGDAS) in order to monitor the geomagnetic field over southern and central Egypt. The first MAGDAS station is already located and tested at Fayum University in Fayum (Mag. Lat. =22.91, Mag. Lon. =103.06), while the second station will be located in Aswan (Mag. Lat. =12.97, Mag. Lon. =103.19) and operated by South Valley University.

The second project was by and between University of Texas at Austin in USA and Helwan University in Egypt in order to conduct joint scientific investigations of the Earth's ionosphere. The parties will develop a network of passive radio instruments to monitor the ionospheric weather associated with the equatorial fountain situated over southern and central Egypt. In order to better understand the spatial and temporal scales over which the equatorial fountain varies, a network of three Coherent Ionospheric Doppler Receiver (CIDR) systems will be deployed in a roughly north-south chain in Egypt. By analyzing the CIDR data set as a function of time and ionospheric drivers, this project will gain valuable new insights into the weather of the equatorial fountain and the radio environment.

OVERVIEW OF THE SPACE RADIATION MEASUREMENTS RESULTS PERFORMED UNDER THE BULGARIAN SPACE PROGRAM

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Overview of the space radiation measurements results performed under the Bulgarian Space program results is presented. The Liulin type spectrometers-dosimeters are designed to measure in Si detector the energy deposition spectrum (in 256 channels) from primary and secondary particles at the aircraft altitudes, at LEO, outside of the Earth magnetosphere on the route and on the surface of the planets of Solar system. The study of the dose, flux and spectra data obtained by Liulin type instruments on spacecrafts (4 different experiments), and aircrafts since 2001 and on the ground since 2006 shows that they are able to characterize well the near Earth radiation environment with relatively very low investments. Different examples of comparisons between measurements and the existing models are presented also. New space research projects are shortly presented.

KASI ACTIVITIES FOR SPACE WEATHER

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It is well known that solar and space weather activities can affect modern technology and human life. Since 2007, the Korea Astronomy and Space Science Institute has initiated a research project for the creation of Korean Space Weather Prediction Center (KSWPC) to make preparations for the next solar cycle maximum (~2011). In this talk, we are going to report on the current progress of KASI activities; extension of ground observation system, construction of space weather database and network, development of prediction models, and space weather researches. In addition, the first result of E-CALLISTO observation at KASI will be present and future plans for KSWPC will be discussed.

PARAMETERS OF THE ARAGATS SPACE-ENVIRONMENTAL CENTER MONITORS AS MEASURED AT START OF 24-TH SOLAR CYCLE

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Particle monitors located at Aragats Space Environmental Center (ASEC) at altitudes of 1000, 2000 and 3200 m above sea level and geographical coordinates (40°25′N, 44°15′E); Vertical cut-off rigidity in 2007: 7.1 GV, detect charged and neutral components of the secondary cosmic rays with different energy thresholds and various angles of incidence. ASEC monitors were equipped with new DAQ electronics and software significantly enlarging information content of collected data. At the start of the 24-th Solar Cycle in beginning of 2008 it was necessary to measure and calculate main parameters of ASEC monitors. Among them are:

- Barometric coefficients for different dead times neutron monitors electronics and for different energy threshold of muon scintillation detectors;
- Energy thresholds of the Nor Amberd Multidirectionsl Muon Monitor and SEVAN detectors;
- Multiplication coefficients of the evaporated neutrons for Aragats and Nor Amberd neutron monitors;
- Count rates of all ~200 measuring channels of ASEC;
- Count rates of different coincidences, corresponding to various angles of incindence of the secondary particles.

All these parameters measured at minimal Solar Activity will comprise a benchmark for further physical analysis of solar modulation events (Ground Level Enhancements, Geomagnetic storms, Forbush decreases) expected during 24th solar cycle).

CHARACTERISTICS OF THE PARTICLE DETECTORS OF THE SPACE ENVIRONMENTAL VIEWING AND ANALYSIS NETWORK (SEVAN)

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One of the major advantages of particle detectors measuring both charged and neutral secondary cosmic rays is probing of the different populations of the primary flux incident on terrestrial atmosphere. With SEVAN network we are measuring fluxes of neutrons and gammas, of low energy charged component and high energy muons. This diversity of information will give possibility to investigate in details solar modulation effects and issue warning and alerts ion dangerous consequences of Space Weather.

To understand sensitivity of new type of particle detectors to highest energy solar ions we investigate the response of SEVAN basic units to galactic and solar protons. Methods of estimation of the index of power spectra of solar cosmic rays incident on the terrestrial atmosphere and – for the distinguishing of the ground level enhancements initiated by solar neutrons also are proposed.

First modules of the SEVAN network are in operation in Nor Amberd research station of Yerevan Physics Institute at altitude 2000 m and in Yerevan headquarters at altitude 1000 m. The count rates of the charged and neutral components of the secondary cosmic rays are registered starting from January 2008, thus comprising benchmark measurements (at minimal solar activity) of starting 24-th solar activity cycle. The comparisons of registered count rates with simulations are performed and presented.

SPACE SCIENCE CAPACITY BUILDING WITH AWESOME ELF/VLF RECEIVERS

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Stanford University has been deploying low-cost-but-science-grade ELF/VLF radio receivers as part of the IHY/UNBSS programs, to facilitate capacity building at host countries which have signifiant potential but which are currently not at all active in space science. The Stanford instrument, called the Atmospheric Weather Educational System for Observation and Modeling of Electromagnetics (AWESOME) are truly state-of-the-art in terms of resolution/sensitivity/dynamic range in spite of their low cost. Accordingly, scientists at host countries can potentially make significant contributions into this field that can go well beyond the educational outreach benefits of this activity. The data from the Stanford systems are sent to Stanford over the Internet, and host scientists and their students have direct access to the data not just from their sites but from other sites. A new on-line data analysis tool has now been developed, and a list of science investigation topics have ben generated, with Stanford scientists working with their colleagues at host sites to pursue data analysis/interpretation with the goal of organization of scientific papers. Initial deployment of Stanford instruments were targeted to North African countries, but the network is expanding now to other sites, such as in Central Asia (e.g., Uzbekistan). A review of the current status of the program and recent science results will be presented.

50 YEARS OF IGY AND NOW IHY: ACTIVITIES OF GEOPHYSICAL INSTITUTE OF PERU CONCERNING IHY

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Huancayo Geomagnetic Observatory was established by Carnegie Institution of Washington in 1918 now the Observatory belongs to Peruvian Government and become Geophysical Institute of Peru. While celebrating IGY in 1957-1958 many international collaborations were established and became a powerful mean to develop sciences within IGP and Peru. A new Solar Station is almost concluded and a Flare Monitor Telescope (FMT) will be moved from Kwasan Observatory of Kyoto University. Details of IGP activities to develop science and basic sciences en Peru will be explained in detail in the talk.

ASTRONOMICAL OLYMPIADS AND INTERNATIONAL HELIOPHYSICAL YEAR

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Ten year experience of organizing astronomical Olympiads in Bulgaria and participation in the International Astronomical Olympiad is presented. In the last years, aims, organizational plan and syllabus of a specialized Astronomy School with a subject of training students for participation in the International Astronomy Olympiad are devoted to the International Heliophysical Year.

The system of selection student from the middle schools is described. A model of identification and selection of outstanding students for astronomical Olympiads has been developed. Examples of didactic systems of problems for development of mathematical, physical and astronomical skills are shown. Possibilities, which the characteristic, non-standard astronomical problems give for stimulating the creative and original thinking, are specified.

Distinctive features of the National Astronomy Olympiad – style of the problems, grading system and organization, aimed at stimulating of creative thinking are shown. Results of the students' papers analysis and students' achievements are discussed.

The programme of identification and support of outstanding students on astronomy is realized in collaboration with The Ministry of Education and Science, Public Astronomical Observatories and Planetaria, Institute of Astronomy Bulgarian Academy of Sciences, Solar-Terrestrial Influences Laboratory BAS and The Union of Astronomers in Bulgaria.

INTERNATINAL HELIOPHYSICAL YEAR - EDUCATION AND PUBLIC OUTREACH ACTIVITIES IN BULGARIA

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Joint initiatives of the Yuri Gagarin Public Astronomical Observatory and Planetarium (PAOP) and Solar–Terrestrial Influences Laboratory of the Bulgarian Academy of Sciences, Stara Zagora, Bulgaria devoted to the International Heliophysical Year (IHY) are described in the work.

Lectures `Astronomy for everybody` are given and observations are conducted whole the year. At the day of the Vernal Equinox on March 21, 2007 a cycle of 6 lectures began in the Art Gallery in Stara Zagora, devoted to the Sun-Earth day and the IHY. We have also given printed materials with the key understandings of the Sun-Earth day `Living in the atmosphere of the Sun - IHY` and annotations for the lectures. A lot of observatories and planetarium from Bulgaria, amateur astronomers, the European Centre for Education and Qualification 'Europe Schools', Stara Zagora celebrated the Sun-Earth day.

Competition "We and the Sun" for paintings and photographs, for students in three age groups – 7-10, 11-15, and 16- 20 years old have also been organized. The exhibition is displaced in the star hall of the Planetarium and it is visited by nearly 200 groups of students and adults.

A cycle of lectures `Cosmos - near and remote` and astronomical observations devoted to April 12 - World Day of Astronautics, Yuri`s Night World Space Party on April 12, 2007, and April 23 - World day of Astronomy began in April 2007.

Summer Solstice festival - municipal competition `The Sun - our nearest star` have been organized and 150 children in 4 age groups participated in it.

The National Summer school of Astronomy for students, solving problems for the International Astronomy Olympiad was in July. Great part of the problems were connected with solar physics and space weather. Seven students participated in the International Astronomical Olympiad in Semeiz, Krimea, Ukraine and visited the Astrophysical Observatory and solar telescopes.

Lectures devoted to pre-historic monuments and cults connected with the Sun considered as a God in the Antiquity were given in September. Part of the monuments connected with the ancient astronomy and included in the World Heritage List have been shown.

We are a host of IHY Space Weather Monitor – SID (Sudden Ionospheric Disturbances) (Bulgaria - 42.2^0 North and 25.4^0 East).

We participated in the Project REGGAE U*NIGHT 2007 of FP 7 on Science and Technology. During the Researchers' Night on September 28, 2007 a photo-exhibition of archaeological objects used for astronomical purposes was arranged in the Zahari Knyazheski Library. Lecture on archaeoastronomy was given and 3D image of the sanctuary in the village of Buzovgrad made on analogy with the images of STEREO (Solar Terrestrial Relations Observatory) was shown (http://www.lesia.obspm.fr/IHY/pages/contacts-bulgaria.html).

We celebrated the 50th anniversary of the First launch of an artificial satellite of the Earth in Cosmos on November 4, 2007. A lecture about Bulgaria in space research was given. Information and press conferences about the events have been regularly made available for mass media.

MULTI-PURPOSE INEXPENSIVE NETWORK FOR GEOPHYSICAL AND ASTRONOMICAL MONITORING

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We are considered possibility of creation of a multi-purpose inexpensive network of the waveform monitoring for geophysical and astronomical researches. This network should be conformed to UNBSSI program of promote space science activities in developing countries by means of deploy of arrays of small, inexpensive instruments.

There is similar structure of receiving station in systems of the spaced sensor waveform measurements in geophysics and astronomy: sensor (in our case it is radio antenna), receiver, system of calibration, system of an exact times and standard frequency, system of registration, storage and transfer of the data. This circumstance allows developing multi-purpose networks of the spased stations. Certainly, multifunctionality and low cost narrow a range of application of a network in each of the chosen directions. At the same time, the multifunctionality promotes interdisciplinary cooperation and well corresponds to the purpose of the UNBSSI program.

The development of a multi-purpose inexpensive network provides for the coordinated choice of research directions, elements of receiving stations, data traffics. In our case, multi-purpose network (operating frequency range is 1…40 MHz) is intended for:

- ionosphere researches with the help of measurements of Doppler spectrum of broadcasting stations carrier wave, galactic noise intensity, variations of propagation time of GPS-signals;
- researches of powerful pulse signals of space radio sources which have low probability of occurence, including some pulse signals of solar radio bursts.

For illustration of such researches we have introduced some results that were obtained by using of equipment of radio telescope network URAN.

SOLAR RADIATION MEASURE OF TOGO

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The photovoltaic applications indicate that one of the fundamental parameters in the determination of the photovoltaic generator is the solar radiation. Therefore it was difficult to constitute these data in spite of the efforts made by the services of national meteorology which measures the duration of the insolation. European or American laboratories by models of simulation propose data. To raise this demolished, the Pulpit of UNESCO ON Renewable Energies of the University proposed to take again measurements of the solar radiation that the laboratory on the solar energy of the university of Lomé undertook since the Eighties. The technical difficulties of the measuring apparatus in time were cured by the acquisition of power stations Li1400. The

Objective of these series of measurements is to lay out for Togo the data of solar radiation and by regional collaborations to constitute a bank to give. These data combined with other data will be able to allow:

- to exploit solar energy judiciously (photovoltaic and thermal)
- to quantify the change climatic and thus to put forward adequate measures necessary.

FIRST ELF/VLF OBSERVATIONAL RESULTS FROM LOW LATITUDE SITES SETUP AT ALLAHABAD, NAINITAL AND VARANASI IN INDIA UNDER IHY/UNBSSI PROGRAM

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In 2007 three AWESOME ELF/VLF receivers were setup in Indian low-latitude region at Allahabad, Nainital and Varanasi under IHY/UNBSSI program, in collaboration with STAR Lab, Stanford University USA to investigate ELF/VLF electromagnetic phenomena in the ionosphere/magnetosphere. The lightning discharges are nature's most powerful generator of electromagnetic radiations, the energy in these electromagnetic pulses vary from few Hz to tens of mega Hz. However major part of this energy is contained in extremely low frequency (ELF, 30-3000 Hz) and very low frequency (VLF, 3-30 kHz) band. The radiations from these lightning discharges travel over thousands of kilometers in the earth-ionosphere wave-guide, to be received as radio atmospherics (or sferics in short), which are extensively used for the ionospheric studies of the D-region. In this process, some part of the radiated lightning energy also penetrates the lower boundary of the ionosphere and travels between the hemispheres along the geomagnetic field lines aligned ducts of enhanced ionization through the magnetosphere before entering the earth-ionosphere wave-guide, to be received as whistlers, emissions, etc. Since these electromagnetic radiations from lightning discharge travel several earth radii out into the interplanetary space, whistlers and VLF emissions all over the globe are extensively used as an important diagnostic tool to probe the Earth's magnetosphere. Magnetic field lines connecting the Indian low-latitude and conjugate region lies in ionosphere, region is also less lightning active. Despite these reasons which are essential for generation and propagation, wide variety of VLF wave activity is observed in Indian low-latitude region like: whistlers, VLF emissions, etc. In this perspective, three advanced AWESOME VLF receivers developed by Stanford University were setup at three low latitude locations in India during 2007 by Indian Institute of Geomagnetism, at GRL, Allahabad (Geomag. Lat., 16.050 N), and in collaboration at ARIES, Nainital (Geomag. Lat., 20.290 N) and BHU, Varanasi (Geomag. Lat., 14.910 N). The paper intends to describe experiment and some preliminary observational results from these stations. The paper elaborate results from tweeks measurements and VLF chorus emissions.

A SOLAR STATION IN A NATIONAL UNIVERSITY: A JOINT PROJECT OF ICA NATIONAL UNIVERSITY, GEOPHYSICAL INSTITUTE OF PERU AND NATIONAL ASTRONOMICAL OBSERVATORY OF JAPAN

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From a new Solar Station at the Universidad Nacional San Luis Gonzaga de Ica Campus will be observed the sun with a 15 cm telescope and a monochromatic spectroheliograph. An old spectrograph was refurbished and equipped with a CCD and will be useful for scholar education and outreach, equipments are provided by Geophysical Institute of Peru (IGP) and National Astronomical Observatory of Japan (NAOJ). People involved from our university are constantly receiving training from IGP and exchanging people with NAOJ to improve technical and scientific knowledges. FMT telescope is projected to be installed in our Solar Station.

The 15 cm telescope was donated by the government of Japan in the 90s actually we can do sunspot observations.

Access to data of the Sun-Earth system from ground-based and space-borne facilities through data archives and virtual observatories

ADVANCED DATA ACQUISITION SYSTEM FOR ASEC EXPERIMENT

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For the reliable and timely forecasts of dangerous conditions of Space Weather world-wide networks of particle detectors operate at different latitudes, longitudes and altitudes. Integration and fast treatment of data from various remote sensors pose stringent requirements on the Data Acquisition system (DAQ) for data storage, retrieval, and analysis as well as hard-ware components control. We report new DAQ system developed for particle monitors located at slopes of mountain Aragats in Armenia.

Detecting equipment of the Aragats Space Environmental Center (ASEC) is located at two mountain research stations at hardly accessible places at distances of 50 and 80 kilometers from the main lab in Yerevan. The detectors are continuously measuring changing fluxes of charged and neutral particles and are used to research solar physics and Space Weather conditions.

Based on new type of particle detectors developed at Aragats, in the context of the International Heliophysical Year (IHY 2007) there is ongoing process of the establishment of world-wide Space Environmental Viewing and Analysis Network (SEVAN). We plan to run SEVAN network under one-and-the same DAQ, enabling fast integration of data for on-line analysis of Solar Energetic Events in progress.

Fully utilizing modular layered architecture the DAQ consists of the number of uniform components spread over the network and connected with Web Service interfaces. The components used to control underlying hardware are implemented in pure C in a very efficient fashion and the plain binary format is used for the data exchange. However, after preprocessing the data is converted to the self-describing mixed XML/Binary format. From that point the system components are implemented on a high level of abstraction and used various modern technologies to bring the data to the operators and data storage subsystem in appropriate form. The operators are able to control all components and underlying electronics as well as monitor current data by means of the AJAX based dynamic web interfaces from standard internet browsers. All components are running on a reliable hardware constructed on the basis of VIA Eden platform.

DATA BASE OF GEOEFFECTIVE SOLAR WIND STRUCTURES, GEOMAGNETIC INDICES, AND ATMOSPHERIC DYNAMICS PARAMETERS

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By the term "solar activity" all types of changes in the appearance or energy output from the Sun are denoted. These changes may have different characteristics, different distribution throughout the solar cycle, and different effects on the Earth. Therefore, when studying solar influences on the Earth, the terrestrial responses should be sorted according to the type of the driver. We are describing criteria to identify magnetic clouds and high speed solar wind streams, and are presenting a data base of solar drivers of terrestrial disturbances, geomagnetic indices, and atmospheric dynamics parameters.

THE JOINT INFORMATION SYSTEM – A DATABASE FOR SOLAR AND HELIOSPHERIC RESEARCH

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The solar physics community has grown over the last years considerably. There are different institutes spread over Europe that work on different fields. Also the space

weather community and heliospheric physics has to be named in this context. The Joint Information System, JIS, was established in the FP6 OPTICON under the networking activity NA2. JIS is an online database containing information about the scientists and institute working in the field of solar physics in Europe. The institutes themselves are responsible for the datainput and their representation in JIS and for the content of the info-pages displaced. The policy of JIS is to provide every scientist and every interested one with these facts without any restriction.

The database was already presented at different meetings and adjustments were made according to suggestions by the users. The main aim of such a database should be to collect information on the different institutions, people working in different research fields and enabling also the user to search for example who is working on CMEs or which institutions work on heliospheric data. Being a project sponsored by the EU, currently the database is limited to the European community but could be extended easily worldwide. The access is easy and a few examples will be given which information can be found and how to get access.

It will be also presented how to become a member of the JIS community.

WEB BASED DATA VISUALIZATION AND PROCESSING TOOLS FOR ASEC AND SEVAN PARTICLE DETECTOR NETWORKS

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ASEC (Aragats Space Environmental Center) facilities provide real time monitoring of particle fluxes incident on earth surface using a number of particle detectors located at high-altitude research stations operated on Mt. Aragats, Armenia by Cosmic Ray Division (CRD) of Yerevan Physics Institute. A world-wide network of particle detectors called SEVAN (Space Environmental Viewing and Analysis Network) is another project started by CRD in the framework of the International Heliophysical Year (IHY), to improve fundamental research of the Solar accelerators and Space Weather conditions. The network will detect changing fluxes of the most of species secondary cosmic rays at different altitudes.

For assessing and analysis multivariate data from ASEC monitors CRD is provided WEB based services named DVIN (Data Visualization Interactive Network) proved to be very useful for physical inference from multivariate time-series and educational purposes. Data from ASEC monitors is accessible on-line from http://crdlx5.yerphi.am/DVIN.

DVIN 3.0 first developed in CRD for internal usage, can be used as a portal for databases of multiple time-series of cosmic ray fluxes observed on earth surface, including various solar modulation effects. This version of DVIN has the following features:

- online processing of data from ASEC monitors;
- joint statistical analyzing of large number of time series;
- correlation analysis of time series;
- online collaboration of users: data processed or raw data interchange, messages interchange;
- work areas manipulation for a long time processing.

New developed version DVIN 4.0 aims for presenting data in Internet. DVIN 4.0 has the following main features:

- large number of presented time series;
- reach features for choosing display options of time series;
- calculation of the statistical parameters of selected time series;
- various transformations of time series;
- downloading of data in several formats: tab separated, comma separated and XML;
- wide usage of Ajax technology

Ajax technology is used for creating interactive web applications. It make the usage of bandwidth minimal so the client-server connections became faster comparing with classic web technologies. DVIN 4.0 is the first attempt to use Ajax technology in cosmic ray analysis web applications. After finalizing this development, CRD software development team is intending to redevelop the DVIN 3 to use Ajax also.

COMPACT WIDE-FIELD SURVEY IR SPACE TELESCOPE DESIGN

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Korea Astronomy and Space Science Institute (KASI) is now developing a compact wide-field survey space telescope, MIRIS (The Multi-purpose IR Imaging System) to be launched in 2010 as the main payload of the Korea Science and Technology Satellite 3. MIRIS will perform astronomical observations in the near-infrared wavelengths of 0.9~2 μm using a 256x256 Teledyne PICNIC FPA providing a 3.67x3.67 degree field of view with a pixel scale of 51.6 arcsec. A high sensitivity will be reached by passively cooling the telescope below 200K and using a cold shutter in the filter wheel for accurate dark calibration. The scientific purpose of MIRIS is to survey the Galactic plane in the emission line of Paα (1.88 μm) and to detect the cosmic infrared background (CIB) radiation. Comparing the Paα map with the Hα data from ground-based surveys, we will test the theories on the origin of the warm-ionized medium (WIM) of the Galaxy and study the physical properties of the turbulence of the WIM such as Mach number and magnetic field strength. The CIB is being suspected to be originated from the first generation stars of the Universe and we will test this hypothesis by comparing the fluctuations in I (0.9~1.2 um) and H (1.2~2.0 um) bands to search the red shifted Lyman cutoff signature. The MIRIS results will be also used to confirm the degree-scale structure found by IRTS and AKARI and reveal its nature.

ORGANIZATIONAL AND METHODICAL PROBLEMS OF THE COMPARISON OF DATA OF THE GROUND-BASED AND SATELLITE MEASUREMENTS

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Deep understanding of solar - terrestrial events requires simultaneous studying of data from ground stations and from satellites. Based on the example of data, obtained within the framework IHY 2007 motion of the realization of projects MAGDAS (MAGnetic Data Acquisition System) and CPMN (Circum- pan- Pacific Magnetometer Network), we examined organizational and systematic questions of the direct comparison ground and space observations. By means of the MAGDAS data analysis in the regime of real time, the monitoring is conducted, and simulation of the current global three-dimensional system and density of external plasma was performed for understanding the electromagnetic and plasma environment changes in geospace during the helio-magnetospheric storms. The data transferring unit transferred the 1-sec averaged data (H+ΔH, D+ΔD, Z+ΔZ, F+ΔF) in real time from the overseas stations to the Space Environment Research Center (SERC) at Kyushu University in Japan by Internet, telephone or satellite.

The experiment "Obstanovka 1-st stage" will obtain its first scientific data in the first half of the 2009 year. The experiment will be realized onboard the Russian segment of the International Space Station(RS ISS). All countries-participants of the experiment (Bulgaria, Hungary, Poland, Russia, Sweden, UK, Ukraine http://www.iki.rssi.ru/obstanovka/eng/) are interested in obtaining scientific data for studying of plasma-wave processes in the ionosphere (380-400 km), connected with the space weather. The ISS orbit is situated on the middle and equatorial latitudes, where the maximum number of ground stations MAGDAS - CPMN is located. The information, obtained in the "Obstanovka 1st stage" experiment, will be transferred (3-5 times a day), through the telemetric systems of the RS ISS, to the Control Center of the ISS (Moscow) and further, by Internet - to Space Research Institute of the Russian Academy of Sciences (SRI RAS). In SRI RAS the preliminary processing will be performed for further distribution of the data by means of Internet to foreign participants of the experiment.

It is possible to organize information exchange between the two scientific communities : "Obstanovka" and MAGDAS-CPMN. For this, a number of organizational and systematic questions must be agreed.

THE MF RADAR TECHNIQUE: POTENTIAL FOR STUDIES IN THE MESOSPHERIC ELECTRO-DYNAMIC ARENA

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All the electric field data available to 1990 were collected with electric field sensors on board more than 50 rockets launched over approximately 30 years in the USSR and the U.S.A., which were insufficient to address mesospheric electrodynamics. This talk focuses on achieving the breakthrough, the development of a radio wave technique for sensing large electric fields remotely by using MF radar, and on the potential for studies in the mesospheric electro-dynamic arena.

The MF radar technique [Manson, A.H.; Meek, C.E.; Martynenko, S.I.; Rozumenko, V.T.; Tyrnov, O.F. (2006) VLF Phase Perturbations Produced by the Variability in Large (V/m) Mesospheric Electric Fields in the 60 – 70 km Altitude Range. In *Characterising the Ionosphere* (pp. 8-1 – 8-24). Meeting Proceedings RTO-MP-IST-056, Paper 8. Neuilly-sur-Seine, France: RTO. Available from: http://www.rto.nato.int/abstracts.asp] permits large (V/m) electric field measurements in a thin layer at the lower edge of the ionosphere. The width of this layer is determined by two inequalities. First, the atmospheric conductivity rapidly growing with height makes it difficult to support an electric field of magnitude above a few mV/m in the mesosphere. This means that large (V/m) electric fields could be generated if electrical conductivity is less than 10^{-10} S/m. Second, the technique require that the signal-to-noise ratio must be greater than about five, which means that electron densities should be of the order of 100 cm^{-3}, depending on the MF radar parameters.

The statistical analysis of the large mesospheric electric field data acquired in the 60- and 67-km altitude region in Canada and Ukraine suggests that large mesospheric electric fields may occur during about 70% of all the time. However, the study of mesospheric electrodynamics needs continuous data on dynamic and electrodynamic parameters at mesospheric heights acquired simultaneously, which remains a major challenge within this problem. First, the technique developed to specify electric fields requires signal-to-noise ratios in excess of a factor of five, which is achieved irregularly with the MF radars used at present. Second, the existing MF radars usually do not permit simultaneous observations of dynamic and electrodynamic parameters.

The electrical processes in the mesosphere are subjected to solar influences via a range of mechanisms, including direct solar heating and chemical, radiative, and dynamical coupling processes, and its investigations have been identified as a convenient means of remotely sensing energy transfer and coupling processes occurring at the lower edge of the terrestrial ionosphere.

The fields generated in this region can also contribute to the global circuit current during transient enhanced conductivity events in the atmosphere below. The fluxes of ionizing radiations are determined either by energetic events on the Sun, or by radioactive materials discharged at the air-earth boundary. The latter involve processes acting in seismically active regions or nuclear power plant accidents. The former includes solar wind modulation of cosmic ray precipitation and solar proton events causing ion pair production at rates many times those produced by cosmic rays, although short lived.

Thus, mesospheric electrodynamics may be used as a tracer for solar influences on the mesosphere.

ON LINE CATALOGUE OF ELECTRIC AND MAGNETIC MEASUREMENTS ON BOARD AMEI-2 DATABASE ON THE WEB

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The low energy plasma composition spectrometer AMEI-2 aboard the high apogee INTERBALL-1 satellite (apogee 27 Re, inclination 600) operated during the whole lifetime of the INTERBALL mission- since August 1995 till October 2000 (http://www.stil.bas.bg/amei-2). It is an energy-mass analyser with angular scanning. Its energy range is 0.3 - 11 keV/q, respectively (m/q)x(E/q)=0.3-160 a.m.u. keV/q^2,

separating m/q = 1,2,4 and ≥16. The energy bandpass is about 16%, covered in 14 consecutive steps. The instrument is a spectrograph type - all masses are measured simultaneously, the different energies and angles are scanned consecutively. In the spacecraft's frame of reference the azimuth angle is sampled while the satellite spins and the polar angle is scanned by an electrostatic scanner. A full scan through all 14 energy bands and all available polar angles defines one 2-D spectrum of the measured ions. The database comprises all AMEI-2 measurements for H^+, He^{++} and O^+ in the form of dynamic spectrograms for each ion species. The view angles scanned are grouped in three bands - up to ~ 55^0, the Solar cone; from 65^0 to 125^0, the 'perpendicular' cone; and from 150^0 to 170^0, the anti-Solar cone. In the spectrograms counts are integrated within the corresponding view coneof ICB-1300

ON LINE CATALOGUE OF ELECTRIC AND MAGNETIC MEASUREMENTS ON BOARD OF ICB-1300

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When processing experimental data, graphic presentation is almost inevitable. Restrictions imposed on report`s size enable authors to publish but a small portion of the analyzed data. Thus, a great bulk of data cannot be revealed to the scientific community. The Catalogue presented in this work implements the idea for graphic presentation of the results from a space experiment.

The satellite IC `Bulgaria-1300` was launched on 07.08.1981 into circular orbit with inclination of 81.9 and height of 900km. Magnetic measurements were done with three-axial flux-gate magnetometer IMAP-1. The measurements of the electric field were done using the Langmuir double probe floating potential method.

The suggested electronic Catalogue contains graphs and text previously stored on HDD and accessible via WEB.

The Catalogue can be accessed at http://www.stil.acad.bg/~mitko/katalog/katalog.html

Solar Physics

ACCELERATION, DYNAMICS AND EMISSION OF ENERGETIC PARTICLES IN SOLAR FLARE LOOPS

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Charged particle acceleration by DC electric field in a flare loop is considered. It is shown that acceleration is quite effective even for electric field value much less then Dreicer field ($E< 10^{14}A$) and magnetic field ($> 10^6G$) will produce due to $dNe/dt \sim 10^{37}$ el/s. The ways out are discussed.

Peculiarities of propagation and emission of accelerated particle in coronal magnetic loop are analyzed. It is shown that due to wave-particle interaction the relativistic electron propagated along loop axis with the velocity 30 times less compared to light velocity. 1 MeV protons produce low polarization degree of Hα emission due to scattering on small-scale Alfven wave turbulence.

IONOSPHERIC FOF2 DATA AND ITS RESPONSE TO SOLAR ACTIVITY CYCLES 21, 22, AND 23

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For solar activity cycles 21, 22, and 23 (1976-2006) the variations of monthly mean values of noon-time foF2 at Slough and Rome are studied. Several markers of the solar cycle activities in terms of the daily sunspot numbers and solar flare index and the daily magnetic index of Ap were then used to seek the possible influences of the solar and ionospheric activities on the critical frequencies observed at the two stations. It is found that the solar flare index, as a solar activity index, is more reliable in determining quiet ionospheric days. We conclude that instead of the ascending and descending branches of the solar activity, it would be advisable to use the extreme epoch values as the solar activity index for predicting and modeling the daily ionosphere during magnetically quiet periods as characterized by the daily magnetic activity index of $Ap< 6$.

WHAT DO WE LEARN FROM TIME-DISTANCE HELIOSEISMOLOGY

Nassim Seghouani

CRAAG

After a brief description of the time-distance method, we present first results obtained on the analysis of local phenomena such as sunspots. Description of the Helioseimology project in Algeria is also presented.

SOME FEATURES OF CONTINUOUS K- AND F-CORONA BRIGHTNESS DISTRIBUTIONS IN LATITUDE AS DEDUCED FROM LASCO DATA

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Two methods - the Hayes–Vourlidas–Howard method (2001) and a simplified method for K- and F-corona brightness separation proposed by the author – were used to obtain continuous K- and F-corona brightness distributions in latitude in the plane of the sky for the first time, depending on distance and time. The results were obtained from LASCO C2 and C3 data. We investigated the distance-dependent variation in the angular scale of inhomogeneity of the F-corona brightness latitude distribution as well as the ratio between the F-corona brightness at the pole, particularly, its maximum value. F-corona brightness variations were studied at long distances ($R=25R_0$, where R_0 is the Sun's radius) within different periods: a month, a year, 11 years (solar cycle). The F-corona brightness latitude distribution was shown to be most variable over the course of a year, and it slightly varies during one solar rotation and in a fixed day of a year in a solar

cycle. Using K-corona brightness data we detirmined the values of electron density in different parts of the coronal streamer belt.

MAGNETIC POLARIMETRIC REFRACTION IN THE SOLAR CORONA

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We present expressions which describe the angular displacement of radio sources due to refraction in a magnetized plasma.The current paper is devote to take into account the combined effect of gradients in the electron density and magnetic field. We use the geometrical optical approximation for determination of the angular broadening of electromagnetic radiation. The expressions obtained are applied to the solar corona environment.

DETERMINATION OF CHARACTERISTICS OF FULL HALO CORONAL MASS EJECTIONS

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A new method recently proposed by the author has been improved for determining geometrical and kinematic characteristics of full halo coronal mass ejections (CME). These characteristics are: CME motion direction, its angular size, CME velocity along the Sun–Earth axis, and others. Results are presented of the use of the advanced method for determining characteristics of total haloes of CMEs that are related to eruptive filaments and/or posteruptive arcades in the visible solar disk. The method relyes on an empirical dependence (discovered by the author) between the angular sizes of CMEs, on the one hand, and of eruptive prominences and/or posteruptive arcades, on the other. The method is also based on relations between CME halo parameters obtained within the framework of three simple geometric conic CME models. Parameters of 45 total haloes of CMEs have been determined with this method using LASCO C3 and EIT data. We made the following conclusions: (1) The trajectories of almost all total CME haloes considered deflect to the Sun–Earth axis as the CME front moves away up to RF > (2–5)Ro A mechanism for such deflection is proposed. (2) The majority of the total halo CMEs analyzed are characterized by relatively big angular sizes, 2alpha, with the mean value of 2alpha ~ 93 deg. that is twice as large as the mean angular size of limb CMEs.

RELATIONSHIP BETWEEN THE CME PARAMETERS AND LARGE-SCALE STRUCTURE OF SOLAR MAGNETIC FIELDS

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The relationship was studied between the parameters of 215 CMEs connected with eruptive prominences on the limb and large-scale structure of solar magnetic fields for 1996-2006. The CME characteristics under examination are the axially directed CME front velocity, angular width and mass. The Coronal Mass Ejections were shown to arise both near the neutral line (NL) of the source-surface magnetic field (base of the coronal streamer belt) and near the lines on the source surface (Chains) dividing the magnetic fluxes from two adjoining open magnetic field configurations of the same polarity (bases of the chains of coronal streamers). The properties of the CMEs arising at the base of these large-scale coronal structures (belt and chains of coronal streamers) were compared taking into account their distance from NL and Chains on the source surface and open magnetic field configurations on the solar surface. An interpretation was proposed to account for different parameters of the two CME groups.

LARGE-SCALE SOLAR MAGNETIC FIELD AND PROPAGATION OF CMES IN THE CORONA

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The relationship was studied between the parameters of 215 CMEs connected with eruptive prominences on the limb and large-scale structure of solar magnetic fields for 1996-2006. The CME characteristics under examination are the axially directed CME front velocity, angular width, mass, and angular deviation of the CME trajectory from radial direction in two propagation areas: at small (1-2.5 R) and large (2.5-20 R) distances of the CME front from the solar surface. The cyclic evolution of the CME trajectory angular deviation from radial direction was analyzed, and probable mechanisms of this deviation were discussed depending on the CME front position.

DECAMETER SOLAR RADIO OBSERVATIONS BY ANTENNAS WITH DIFFERENT EFFECTIVE AREAS. PERFORMANCE ANALYSIS OF GROUND- AND SPACE-BASED INSTRUMENTS

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Decameter solar radio emission is characterized by a various fine structure of solar bursts. Their study requires a sufficient sensitivity of antenna systems. In this purpose we have analyzed an influence of the radiotelescope-antenna effective area on the performance of decameter solar radio observations. We present results of decameter solar observations in the same time by different radioastronomical instruments. From the beginning we observed the solar radio emission by the array of 720 ground-based dipoles and one single dipole of the radiotelescope UTR-2 (Ukraine). It's shown that a larger effective area of the ground-based antenna allows us to study a weaker solar emission and to distinguish a fine structure of strong solar radio events. The comparison is also examined with simultaneous ground- and space-based observations in the same frequency range.

SHOCK WAVES IN SOLAR CORONA AND IMPORTANCE OF PARALLEL AND PERPENDICULAR HEAT CONDUCTION AND DIFFERENCE OF ONE-FLUID AND TWO-FLUID STRUCTURE IN SOLAR CORONA

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Magnetic reconnection plays an important role in solar flares, coronal heating and geomagnetic substorms. Several different types of magnetohydrodynamic (MHD) discontinuities can be produced by magnetic reconnection. Heat conduction can significantly modify the temperature and pressure in the inflow region of magnetic reconnection. In past studies, the heat conductivity parallel to the magnetic field was much larger than the perpendicular conductivity but SOHO observations have shown that perpendicular heat conductivity plays an important role in a magnetic reconnection region. In our study, and based on the observational evidence from the SOHO spacecraft, the effects of parallel and perpendicular heat conductivity together on the slow shock structure were calculated. In addition to this, we applied two-fluid shock wave structure to our equations and so, we could see the different behaviours of electrons and ions easily in the magnetic reconnection region.

CORONAL MASS EJECTION OF SOLAR FLARE EVENTS: PROPERTIES, CHARACTERISTICS, GEOEFFICIENCY.

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Research of coronal mass ejection has naturally led to concept solar flare events which includes all process of energy output as actually solar flare with its displays in all ranges of electromagnetic and corpuscular radiations, and all spectrum of the accompanying dynamic phenomena: solar filament ejections, propagation of shock and other waves and disturbances to a corona of the Sun and in a heliosphere. Depending on size of a magnetic field in which it develops solar flare event can represent either solar flare, or solar filament ejection that is possibly reflected in characteristics caused by them of coronal mass ejection phenomena. In 23 solar cycle the number of observation solar flare events including a full time number and enough of lengths of waves has sharply increased to judge a source of coronal mass ejection in particular solar flare event. There was an opportunity precisely to divide coronal flare ejection from flares, from solar filament ejections and backside events. Therefore, within the limits of research solar flare events, the Catalog of solar flares 23 cycles has been created. The structure of the catalog contains data about all solar flares of a x-ray class ≥M1 for all time of development of the solar activity last cycle (1996 - 2008). In it time characteristics of flares, their localization on the solar visible disk, data about dynamic radio burst, coronal mass ejection and hard x-ray Emax accompanying the given solar flares are resulted. Data about coronal mass ejection have allowed to restore coordinates of flares when was not Ha-patrol, to specify localization of solar flares in the given active region. Questions of geoefficiency solar flare events depending on characteristics CME are discussed

PHYSICS OF THE SOLAR CYCLE: NEW VIEWS

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Deviating from the traditional dynamo mechanism, we model the solar cycle as a forced and damped harmonic oscillator and from all the 22 cycles (1755-1996), we obtain long-term amplitudes, frequencies, phases and decay factor. For all the solar cycles, we find that amplitude and frequencies of the sinusoidal part remain constant and a very small decay factor from the transient part. These results suggest persistent MHD oscillations that might be compatible with long-period (~ 22 yr) Alfvenic oscillations. The persistent 11 year solar cycle and Maunder-minimum type of solar activity is explained as a result of coupled poloidal and toroidal MHD oscillations.

THE B_Z COMPONENT IN CMES AND IN THEIR SOURCE REGIONS

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The geoeffectiveness of CMEs is mainly dependent on the presence of negative Bz component inside the structure. Some model and observational studies suggest that during the transit from the Sun to the Earth, the CME preserves the magnetic field configuration its source region, which implies a self-similar expansion of the structure. If this is true, it will have important consequences for the possibility to forecast geomagnetic disturbances 2-4 days in advance from remote observations of the Sun. In the present study we analyze the conception of the retainment of Bz component. We use the dimmings to localize the CME source region, and compare the IMF observed at the Earth orbit to the coronal magnetic field at 1,1-1,3 Rs calculated in a potential field approximation from synoptic maps of the observed photospheric fields. The preliminary analysis of several tens of events demonstrates that in 65-70% the Bz components in the geoeffective dimmings and in the CMEs registered at the Earth orbit have the same sign while in 15-20% they have opposite signs.

INTERPLANETARY TRANSIENT SOLARWIND FLOWS AND THEIR GEOEFFECTIVENESS

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The interplanetary transients are large scale structures containing plasma and magnetic field expelled from the active regions of solar atmosphere. We have studied the Bi-directional Electron Heat Flux (BEHF) Events. These are the fast magnetized plasmoids moving away from the Sun in to interplanetary space. As they come to interplanetary medium the interplanetary magnetic field drape around them. This field line draping was thought as possible cause of the characteristic eastward deflection and giving rise to geomagnetic activities. In this paper a systematic study has been performed to analyze these BEHF events occurred during solar cycle 23, by dividing them in two categories 1. Associated with coronal holes (CH) and 2. Non - Associated with coronal holes. In this work we used hourly values of IMF data obtained from the NSSD Center. The analysis mainly based on looking into the effects of these transients on earth's magnetic field. The high-resolution data IMF BZ and solar wind data obtained from IMP-8 satellite was available during the selected period. Dst and Ap are taken as indicator of geomagnetic activities. It is found that Dst index, solar wind velocity, proton temperature and the Bz component of magnetic field have higher values and increase just before the occurrence of these events. Larger and varying magnetic field mainly responsible for producing the short-term changes are observed during the BEHF events associated with coronal holes.

SOLAR 23RD CYCLE IN THE DEVELOPMENT

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The main properties of the current cycle match almost completely those of average-magnitude solar cycles, and some of the features of the current cycle may indicate a change in the generation mode of magnetic fields in the solar convection zone. In this case, the Sun enters a period of intermediate and weak cycles of solar activity (SA) in terms of the Wolf numbers, which may last for 50 to 100 years. This change may result in further pollution of the Earth's environment (near-Earth space) due to the unfavorable regime of removing cosmic garbage from low-Earth orbit, the substantial increase of the radiation background in near space (the weakening of interplanetary magnetic fields will result in an increased concentration of galactic cosmic rays in the heliosphere), and other, possibly unfavorable, consequences. The main development stages of the 23rd solar-activity cycle are the following: the minimum of the 22nd solar cycle, May 1996 (W*= 8.0); the beginning of the growth phase, September 1997; the maximum of the smoothed relative sunspot number, April, 2000; the global polarity reversal of the general solar magnetic field, July to December 2000; the secondary maximum of the relative sunspot number, November 2001; the maximum of the 10.7-cm radio flux, February 2002; the phase of the cycle maximum, October 1999 to June 2002; the beginning of the decrease phase, July 2002; the most powerful flare events of the current cycle, October to November 2003; last powerful flare active region of solar cycle 23, December 2006; the likely point of minimum of the current SA cycle, September to November 2007.

DECAMETER TYPE IV BURSTS

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We report the results of observations of some Type IV bursts, which were registered at radio telescope UTR-2 (Kharkov, Ukraine) during period 2003 - 2005. Detection of Type IV bursts in wide band from 10 to 30 MHz with high sensitivity and time resolution allowed to study their properties. These bursts show increased radio emission with fluxes

10-1000 s.u.f. In some cases such bursts lasted some hours. In all cases Type IV bursts have fine structures in the form of sub-bursts with durations from 2-3 s to 10 s. Their frequency bands were from 1-2MHz to 6-8MHz. For the most of sub-bursts their frequency drift rates were more than 1MHz/s and sign of drift rates was both positive and negative. The Type IV burst observed at July 22, 2004 had zebra structure, in which single zebra stripes had positive, negative and infinite drift rates. For some Type IV bursts we registered bursts in absorption.

LONG-TERM VARIATIONS IN THE HEMISPHERIC ASYMMETRY OF SOLAR MERIDIONAL CIRCULATION AND SUNSPOT ACTIVITY

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Large-scale meridional circulation is a key element in the flux-transport dynamo mechanism of solar magnetic field generation. The speed of the meridional circulation is supposed to rule the period and the amplitude of the sunspot cycle. In a previous work we have used geomagnetic data to infer the long-term variations in the solar meridional circulation averaged over the two solar hemispheres. It is well known, however, that the solar activity is not absolutely symmetric in the two hemispheres, differing in both phase and amplitude. In the present work we extend our study to evaluate the long-term variations in the surface and deep meridional circulation in the northern and southern solar hemispheres, and compare them to the sunspot activity in the two hemispheres.

THE ROLE OF SOLAR WIND DENSITY SHARP INCREASES IN ORIGINATION OF GEOMAGNETIC STORMS

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Statistical and case-study investigations of the origin of mild and weak geomagnetic storms show that such types of storms are produced mainly by sharp increases of solar wind density in combination with consequent southward orientation of interplanetary magnetic field. These conditions are not coincided with the typical ones for exciting of severe geomagnetic storms (like high solar wind velocity in combination with strong negative Bz-component). This fact is main cause of low quality of middle-term prognosis of magnetic storms, based on prediction and detection of CME-like conditions in solar. Several lists of geomagnetic storms years were used for analysis: list of geomagnetic storms with sudden commencement, McPherron`s list of magnetic storms in the space age (1964-2003), list of major geomagnetic storms. The studies show that the solar wind density plays a more significant geoeffective role than it was previously assumed. A sharp density increase and consequent negative Bz can produce weak, moderate and even strong magnetic storms without any significant changes of the solar wind velocity.

CHARACTERISTICS OF THE HIGH SPEED STREAMS DURING POLARITY REVERSALS OF THE SOLAR MAGNETIC FIELD

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The polarity reversal of the solar magnetic field occurs just after the 11-year solar cycle maximum and constitutes an important phase in the solar cycle development. The new poloidal magnetic field is completely established about 3–4 years before the end of the old cycle. The two solar hemispheres do not necessarily reverse their magnetic polarity at the same time; there are often periods of months or even more than one year when the two polar regions of the Sun have the same polarity. Such a reversal is a very complex process and it is often produced during some time intervals, in one step or more.

During reversal intervals the polar coronal holes disappear and start to re-form in the end of them. Some open magnetic flux remains in the active region latitudes, where small coronal holes with strong and deep footpoint of their fields generate predominantly slow solar wind. The complex coronal magnetic topologies are determined by the non-

dipolar nature of the large-scale coronal field at sunspot maximum and, a four-sector structure of the current sheet is present.

This paper analyzed the specific features of the high speed streams in the solar wind during four magnetic reversals, which took place between 1964–2007 years (solar cycles nos. 20–23). We used the Catalogues of the high speed streams for solar cycles 20–23 and the reversal intervals already well-defined by different authors. The rapid stream parameters (durations, maximum velocity, the maximum gradient of the velocity and, the importance of the streams) as well as the solar sources of the high speed streams were analyzed. During the reversal intervals, all the high speed stream parameters have comparable values with the ones for the maximum phases of the cycles.

This study was done in the framework of the IHY Coordinated Investigation Program no. 69.

LONG-TERM VARIATIONS IN THE GLOBAL MAGNETIC FIELDS, SUNSPOT ACTIVITY, AND MERIDIONAL CIRCULATION

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In the past 3 sunspot cycles, the correlation between solar activity as expressed by the sunspot number, and geomagnetic activity measured by the aa-index, has been steadily decreasing. We investigate the behaviour of the solar magnetic field and show that the polar magnetic field has been also decreasing during the past 3 cycles, due to the distinct decrease of the magnetic moment of the solar dipole since 1976 relative to 1915-1976. In the same time, the fields of medium scale (such as those of isolated coronal holes) have been abnormally strong in the recent cycle, explaining why the tilt of the heliospheric current sheet is recently so large (about 30 degrees). This is also confirmed by calculations of the effective multiplet index. Additionally, the heliospheric current sheet is strongly shifted southwards (by about 10 degrees), due to the abnormally large sunspot activity in the southern hemisphere. We look for a connection between the long-term variations in the solar global magnetic fields and solar meridional circulation to explain the variations in the correlation between the aa index and sunspot number. Our analysis may indicate the advent of a Maunder minimum or, at least, the epoch of a number of low or moderate solar cycles.

THE SOLAR FLARE ACTIVITY PREDICTIONS ON THE BASE MICROWAVES RADIO-EMISSION OF COMPLEXES ACTINITY AND COMPLEXES ACTIVE REGIONS

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Now there are many observation of a millimeter solar radio emission during the period of 20-23 cycles of solar activity. The radio images of the Sun received on RT-22 Crimean Astrophysical Observatory and RT-14 Metsahovi Radio Observatory in Finland on 2,4,6,8,13 and 17 millimeters. On the solar maps local radiosources that form compact complexes of active regions (CAR) and long space complexes of activity (CA) are received. In this report the tecnique and resalts of data use about spectra are presented and also the evolution of radio emission of these complexes for long-term forecasting of solar activity periods.

SPACEWEATHER VARIATIONS AS PRECURSORS FOR SOLAR FLARE PREDICTION

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We describe our recent effort to investigate solar flare precursor signatures from key space weather parameters. Variations in the Southward Interplanetary Magnetic Field (IMF Bz)and solar wind speed for 1997-1999 is investigated. A possible interpretation is given to the change in the solar wind speed and B_z field preceeding solar flares

CORONAL MASS EJECTION OF 26 FEBRUARY 2000: COMPLETE ANALYZE OF THE THREE-PART STRUCTURE CME

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We analyze the kinematics and morphology of the limb coronal mass ejection (CME) of 26 February 2000, utilizing observations from Mauna Loa Solar Observatory (MLSO), the Solar and Heliospheric Observatory (SOHO), the Geostationary Operational Environmental Satellite (GOES) and Yohkoh. Also, we analyze the relation between dynamics of the CME and the energy release in the associated flare. A complicate stucture (prominence, prominence-like absorbing feature, cavity and bright overlying arcades) is clearly recognizable in the low corona during the pre-eruption phase of slow rise. This provided measurements of kinematics of verious features from the very beginning of the eruption up to the post-acceleration phase which was followed up to 32 solar radii. Such events are observed only occasionally, and are of great importance for the comprehension of the nature of forces driving CMEs. The acceleration maximum was attained at the radial distance of 2,4 solar radii from the Sun`s center and ceased beyond 10 solar radii. The time profiles of the acceleration of various features of CME are showing `self-similar` expansion and implying a common driver. The acceleration phase was synchronized with the impulsive phase of the associated two-ribbon flare. Observations provide clear evidence that CME eruption is causing a global restructuration of the magnetic field in the outer and inner corona. Furthermore, kinematics and morphological properties of this CME show possibility that in some events the prominence can evolve into a structure which looks like three-part structure CME, i.e. where the frontal rim is just a part of helically twisted prominence.

ANALYTICAL STUDY OF SOLAR ENERGETIC FLARES DURING CYCLE 23

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There are many effects of the solar phenomena on the space weather and earth's atmosphere. Solar flare is the high energetic phenomenon in the solar atmosphere. In the present work, a Fourier transformation analysis has been applied on time series for the most solar energetic during the last solar cycles 23. The used data of solar flares are he northern hemisphere flares, southern hemisphere flares and the daily solar flares on the total solar disk. The used data were obtained from solar-geophysical data of NOAA, Colorado, and USA.

The results are promising and can be used for proton flares and Geomagnetic Storms prediction, few days before their occurrence. The reasons of release these Eruptive Storms and then flares, during the decline phase of the solar cycle23, and also during the decline phase of the last 5 cycles. The analysis led to interested results for long-term periodicity and its relation to the theoretical mode of solar activity and core oscillations.

HIGH FREQUENCY OSCILLATIONS AND THEIR CONNECTION TO CHROMOSPHERIC HEATING

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High frequency accoustic waves have been suggested as a source of Techanical heating in the chromosphere. In this work the radial component of waves in the frequency interval 22mHz to 1mHz are investigated. Observations were performed using 2D spectroscopy in the spectral lines of Fe I 543.45mm and Fe $_{I}$543.29nm at the Vacuum Tower Telescope, Tenerife, Spain. Speckle reconstruction has been applied to the observations. We have used Fourier and wavelet techniques to identify oscillatory power. The energy flux is estimated assuming that all observed oscillations are acoustics running waves. We find that the estimated energy flux is not sufficient to cover the chromospheric radiative loses.

INVESTIGATION OF THE DIFFERENTIAL ROTATION BY HA FILAMENTS AND LARGE-SCALE MAGNETIC ELEMENTS FOR SOLAR ACTIVITY CYCLE 20

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The solar rotation is closely related to the mechanism of solar activity. In spite of the observational and theoretical investigations during many years it is not still fully understood. The purpose of our paper is to investigate of the solar differential rotation with H-alpha filaments and compact large-scale magnetic elements with negative/positive polarity. For solar cycle 20 the solar differential rotation is investigated by using data on annual average angular velocities of quiescent Hα filaments from Hα photoheliograms of the Georgian National Astrophysical Observatory film collection and large-scale compact magnetic elements from the "Atlas of Stackplots derived from Solar Synoptic Charts" by McIntosh (1991).

We have found that the rotation rates of the large-scale magnetic elements are higher than those of the H-alpha filaments and former rotate more rigidly than latter.

ABOUT OF QUASI 11-YEAR'S VARIATION OF THE SOLAR CONSTANT VARIOUS PARAMETERS OF THE HELIO-GEOPHYSICAL PHENOMENA AND SOLAR WIND

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Variations of the characteristics of the solar constant observed by the satellite "NIMBUS-7" and solar wind during 1978-1991 are studied by a complex analysis. A 10-year period is revealed in the variations of the Wolf's number, the number of solar flares, the intensity of the solar radio emission, the solar wind plasma parameters (velocity, concentration), galactic cosmic rays, the number of storms with a sudden commencement and the geomagnetic indices (Ap, aa) for the given epoch.

Variations of the solar constant and the electron concentration of the ionosphere F2 layer occur rather synchronously, with a period of 12 years. The variations of the solar constant and the electron concentration of the ionosphere F2 layer should be caused by changes in the solar active features such sunspots, solar flares, bright faculae, coronal mass ejections etc. The analysis of the TSI data and the spectral distribution of the intensity of solar electromagnetic radiation found that the 12-year variations in the solar constant are connected with the variations of solar radiation in the range λ≈ 4-1000 ÅÅ.

A CATALOG OF HALO CORONAL MASS EJECTIONS FROM SOHO*

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The Halo CME Catalog contains all the Halo CMEs identified in the SOHO/LASCO Data (1996- to date). Most information available in the general CME catalog is also available for halo CMEs. In addition, heliographic coordinates of the source from which the Halo CMEs erupt, the soft X-ray flare importance, and the flare onset time are included. In the near future, deprojected speeds will be included. This catalog is useful to the Living With a Star (LWS) and Space Weather communities for research and educational activities. The catalog will also be accessible from the Virtual Solar Observatory (VSO) site URL: http://cdaw.gsfc.nasa.gov/CME_list/HALO/halo.html

Planetary Magnetospheres

THE SOLAR WIND ENERGY INPUT RATE AND RECOVERY OF THE MAGNETOSPHERIC RING CURRENT DURING THE TWO LAST SOLAR CYCLES

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This study presents the recent results of our calculations of the solar wind energy input rate to the magnetospheric ring current in the main phase of magnetic storms. Simulation of Dst index on the basis of the solar wind rate energy input to the ring current and the adjustment for the solar wind dynamic pressure with the exponential decay rate of the ring current has more than thirty year-old history. The key elements of the models were reanalyzed in numerous works and a lot of Dst-index calculations were carried out. The differences between the calculated and observed Dst values in these models may be accounted to all key elements of the models. In this study the main element of the model - the rate of energy input to the ring current is analyzed. For this purpose we continued studying the solar wind parameters during the two last solar cycles. We looked for the acceptable geomagnetic storms and intervals for calculation of the solar wind energy input rate function to the ring current. Intense solar and geomagnetic activity that had occurred on October- November 2003 and on July and November 2004 allowed us to find the acceptable intervals for the wide range of the solar wind electric field more than 30 mV/m. It should be noted that previous calculations were carried out from 0.2 mV/m to 16 mV/m of the solar wind electric field values. Furthermore, there were a lot of small geomagnetic storms during the 22 and 23 solar cycles to correct of injection function for small geomagnetic storms. These calculations show us that the relationship between rate change of the ring current and Ey-component of the solar wind remains linearly proportional for great Ey values as in the case of small storms. From this result it is evident that there is no need to use complex nonlinear models for calculation of hourly Dst index. We present the simplest algorithm for calculation the Dst-variations in order to facilitate problem of users and for the quick estimation of Dst-index from the solar wind data directly. The algorithm arises from the fact that energy input to the ring-current is proportional to the Y-component of the solar wind electric field and from our physical regularities for the ring current obtained earlier. Calculations of the Dst variations on the basis of the algorithm for the geomagnetic storms of different intensity have carried out.

NONLINEAR DYNAMIC-INFORMATION MODELS OF THE MAGNETOSPHERE FOR SPACE WEATHER PREDICTION

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We propose a new method of predicting Dst index variations, based upon a discrete dynamical model and multicriteria identification of its structure and parameters. We developed two new algorithms of identification of discrete "input-output" models with high precision and reliability of Dst index prediction. They were tested on model samples and it was shown that they are capable of predicting Dst index 7-9 hours ahead. The linear correlation coefficient of predicted and official Dst index was about 95% for 1-hour prediction.

Using the procedure of nonlinear perturbations into series in correlation functions up to 3rd order inclusive, we constructed a discrete dynamical model of magnetospheric state. In numerical modeling we used a product of IMF southern component by solar wind flow velocity as the input, and Dst index as the output. As a result of numerical experiments we demonstrated the possibility of Dst index prediction (or "space weather" state) on the temporal interval of 100 hours provided that there are no anomalous perturbations in the solar wind. We found out that the prediction matches observational data with linear correlation coefficient of 95%.

3D GLOBAL SIMULATION OF THE INTERACTION OF INTERPLANETARY SHOCKS WITH THE MAGNETOSPHERE

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It is well known that the sudden commencement of geomagnetic storms may be caused by the global compression of the magnetosphere as a result of interplanetary disturbances such as shocks, dynamic pressure pulses etc. Before interplanetary shocks reach the magnetopause, they interact with the bow shock and traverse the magnetosheath. Understanding the interaction of interplanetary shocks with the magnetosphere is crucial to space weather studies.

Using a recently developed PPMLR-MHD code, we carry out a global numerical simulation of the interaction between interplanetary shocks and the EarthЎЇs magnetosphere. The initial magnetosphere is in a quasi-steady state, embedded in a uniform solar wind and a spiral interplanetary magnetic field (IMF). The arrival of an interplanetary shock wave causes the abrupt displacement of the whole bow shock-magnetopause system toward Earth, an enhancement of the magnetic field strength and field-aligned current in the magnetosphere, and an increase of the dawn-dusk electric potential drop across the polar ionosphere. The shock front projects tailward in the magnetosphere because of a much higher Alfven speed over there. After the shock passes through, the system approaches a new quasi-steady state, which is determined by the downstream state of the shock. The effects of the shock orientation on the interactions are also investigated.

FLOW STRUCTURE AND FRACTAL DIMENSION OF THE SOLAR WIND PLASMA IN NEAR-EARTH SPACE AT THE MINIMUM OF SOLAR ACTIVITY CYCLE N23

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The solar-wind (SW) flow structure in the near-Earth space comprises the well-known global features, such as fast flows of coronal holes, propagation of the heliospheric plasma sheet, sporadic flows of coronal mass ejections (CME), flare-generated flows most effective in producing geomagnetic storms, slow SW flows over sunspot regions in the absence of flares, and varying flows in the co-rotating regions (CIR), presumably, on the leading boundary of high-speed SW streams from CHs. Sporadic and recurrent processes are two general, well-distinguished features of solar activity. The sporadic short-lived events (flares, coronal mass ejections, filament emissions) add complexity to the picture of long-lived phenomena (sunspots, active regions, background fields, coronal holes, heliospheric plasma layer) during the diagnostics of solar wind variations.

Radial propagation of the solar wind with interplanetary magnetic field all over the heliosphere beyond 10 RSun is a manifestation of the open nature of the solar magnetosphere. The SW parameters can be analyzed by the fractal method proposed by T.Higuchi (1988). The fractal dimensions (FD) of the solar-wind plasma and IMF parameters near the Earth are calculated to yield FD variations that reflect the structure and transformation of SW flow. In our study, we have used the Wind data obtained with a 6-hour sliding-scale window at 3-hour steps. The time digitization is ~95 s. Calculating the fractal dimension allows us to classify the SW flows according to the general flow types mentioned above. E.g., FD~1.7-1.9 corresponds to fast coronal-hole flows, while the transition to the heliospheric plasma layers is accompanied by a sharp fall down to FD~1,5. In the co-rotation regions, a fast variation of the fractal dimension precedes the arrival of fast SW. The CME and flares display individual FD variations associated with compressed plasma layers and more complex IMF. The fractal analysis helps us to classify the SW flows and intermediate boundary regions in SW.

MAGDAS PROJECT AT SERC FOR SPACE WEATHER AND ITS PRELIMINARY RESULT

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The Space Environment Research Center (SERC), Kyushu University is deploying the MAGnetic Data Acqusition System (MAGDAS) at 50 stations in the Circum-pan Pacific Magnetometer Network (CPMN) region, and several FM-CW radars along the 210-degree magnetic meridian. The MAGDAS project has the potential to contribute greatly to IHY by supporting ground-based magnetometer array for worldwide studies, and by demonstrating the beauty, importance, and relevance of space science to the world. 20 and 10 MAGDAS units were installed in collaborations with 30 organizations in the world, respectively, along the 210-degree magnetic meridian in 2005 and along the magnetic dip equator in 2006. In the year 2007, 10 MAGDAS units have been deployed in places such as Antarctica, South Africa, India, etc. The MAGDAS II project is newly planned to construct a magnetometer chain along the 110-degree magnetic meridian from South Africa to Hungary in 2008-2009. By using these data from the 210-degree and the 110-degree MM stations, it will be possible to examine the local time asymmetry of magnetospheric disturbances. The goal of MAGDAS is to become the most comprehensive ground-based monitoring system of the earth's magnetic field.

The projects intend to get the MAGDAS network fully operational and provide data for studies on space weather. By analyzing these new MAGDAS data, we can perform a real-time monitoring and modeling of the global 3-dimensional current system and the ambient plasma mass density for understanding the electromagnetic and plasma environment changes in geo-space during helio-magnetospheric storms.

In the present paper, for clarifying propagation mechanisms of transient disturbances, i.e., SC, Pi 2, and DP2, we investigated relations of ionospheric electric and magnetic fields by analyzing the MAGDAS/CPMN magnetic data and the Doppler data of our FM-CW ionospheric radar. The following results were obtained:

(1) The ionospheric electric fields at lower latitudes during SC events are found to consist of two components. One is the dawn-to-dusk electric field, which penetrates from the polar ionosphere into the day- and night-side equatorial ionospheres, and the other is the global westward electric field ($\delta \boldsymbol{E} = - \mathbf{v} \times \mathbf{B_0}$), which may be induced globally in the ionosphere or caused by a global earthward movement ($\mathbf{v}$) of the ionospheric plasmas.
(2) Pi 2 magnetic pulsations at the world-widely separated stations near the dip equator are found to show an amplitude enhancement around each 10:00-13:00 local time. Low-latitude Pi 2 electric and magnetic pulsations observed by the MAGDAS and FM-CW radar show characteristics of radially propagating compressional and radially standing cavity modes.
(3) 160 quasi-periodic DP2 magnetic fluctuations, which were associated with the southward IMF, were identified at the dayside dip equator during December, 2006-March 2007. 36% of all the events are found to have simultaneous fluctuations in the nighttime, which show in-phase relationship to the dayside DP2. However, the nighttime DP 2 cannot be explained by using the penetration model of dawn-to-dusk electric field from the polar into the equatorial ionospheres.

SUBSTORMS ASSOCIATED WITH DIFFERENT STRUCTURES IN THE SOLAR WIND

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On the basis of data from WIND spacecraft we investigated the difference in the behavior of substorm development during different types of solar wind streams: recurrent solar wind streams (RS), co-rotating interaction regions (CIR), magnetic clouds (MC), and the region of interaction of magnetic clouds with undisturbed solar wind (Sheath). The RS/CIR (MC/Sheath) structures were examined for the period December, 1996 - June, 1997 (January - December, 2000). All available auroral substorms observed by the Ultra Violet Imager onboard the Polar spacecraft during these periods were studied. It is shown that substorm expansion behavior is different for these four types of the solar wind. The strongest auroral bulge expansions are found for CIR and Sheath situations. In contrast to substorms during RS, during MC the latitudinal expansion of the auroral bulge is less pronounced, but longitudinal expansion is stronger. We suggest that later feature is explained by different configuration of the near-Earth magnetotail during RS and MC.

ONE SATELLITE LARGE SCALE FIELD ALIGNED CURRENT MEASUREMENTS COMPARED WITH EMPIRICAL MODELS

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We study Large Scale (LS) Field Aligned Currents (FAC). Their density is estimated with simple procedure from magnetic field (MF) measurements on one satellite. We find that LS FAC strength and thickness differ from some popular empirical LS-FAC models.

The sources of this non-coincidence can be (a) measurements; (b) the right choice of model input parameters; (c) the smoothing of MF measurements done in process of models construction

To avoid some of reasons above, we select periods with quiet Solar Wind parameters.

We discuss the possible reason for the observed discrepancy between the measured and modeled FACs and found that the selection of model`s input parameters is difficult and fuzzy.

RAPID SOLAR WIND IMPACT ON THE GEOMAGNETIC VARIABILITY DURING FOUR SOLAR CYCLES (NOS. 20 – 23)

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The geomagnetic disturbances are produced by the impact of the heliospheric magnetic perturbations and high speed solar wind on the terrestrial magnetosphere. Physical parameters of the rapid solar wind determine its geomagnetic effectiveness.

This paper analyses the geomagnetic variability during four solar cycles (nos. 20–23, 1964–2007) using some indices, such as: aa, Ap, Dst, in comparison with the variation of the rapid solar wind parameters (the maximum velocity, the maximum velocity gradient and, the importance of the high speed streams). The World Data bases for geomagnetic indices and the high speed stream catalogues for solar cycles 20 – 23 were used.

The most powerful geomagnetic disturbances were registered as a consequence of the composed external perturbations e.g. a superposition of two streams with different solar sources or a stream combined with the inhomogeneous heliospheric current sheet (the change of the magnetic polarity) inside them. The heliospheric position and extension of certain solar sources (e.g. coronal holes, coronal mass ejections) or the intensity of eruptive solar sources (e. g. flares) also contributed to the stream geoeffectiveness.

This study is done in the framework of the IHY Coordinated Investigation Program no. 69.

TRANSIENT APPEARANCE OF PLASMA SHEET - LIKE PLASMA STRUCTURES IN THE MAGNETOTAIL LOBES. INTERBALL-1 AND CLUSTER OBSERVATIONS

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Plasma structures of various duration with quasi-isotropic velocity distributions resembling the plasma of the plasma sheet (PS) are often observed in the magnetotail lobe. Previous studies performed on basis of Interball-1 observations revealed that the spatial distributions of such structures along the south-north direction depend on the direction of interplanetary magnetic field (IMF). When IMF is northward, PS-like plasma fills lobe region that may be related with the PS expansion. For southward IMF intervals the probability of observing PS-like structures of long duration sharply decreases with the distance from the nominal neutral sheet (NS), but PS-like structures of short duration (less than 500s) are distributed almost uniformly up to 12 Re above the NS. Such transient observations of PS-like plasma may be caused by large-scale disturbances of the boundary of preliminary expanded PS. Multipoint Cluster observations allow to study the direction of motion of such structures, pressure balance between the plasma pressure

inside the structure and the magnetic pressure in the adjacent lobe and in some cases to study spatial geometry of these structures. Such analysis gives us the opportunity to reveal whether the observation of PS-like plasma in the lobe is related with stable plasma filaments drifting towards the NS or it is associated with sudden disturbance of PS boundary which could be related to plasmoid propagation.

MAGNETOTAIL LOBE POPULATION AS MEASURED BY INTERBALL-1 SATELLITE

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Experimental evidence about the lobe population is very scarce as to measure this tenuous plasma a spacecraft on a high apogee high inclination orbit is needed and the plasma instrumentation should be capable to measure weak particle fluxes. The survey of INTERBALL-1 measurements in the near (up to -27 Re) lobes shows that they are populated with plasmas of various origin and properties. Discrete plasma structures encountered in the lobes could originate from the plasma sheet, from the magnetosheath or the mantle. A ubiquitous picture in the lobes is the registration of `clouds` of anisotropic electrons with energies up to 300 - 500 eV, with no accompanying ions. A small part of these electrons precipitate in the polar caps as polar rain. Though the polar rain is uniform over the whole polar cap, electron density in the magnetically connected with the caps magnetotail lobes is not uniform. We analyse and discuss the dependence of the lobe electron density on various conditions.

SOLAR WIND ENERGY INPUT RATE TO THE MAGNETOSPHERIC RING CURRENT AND SIMULATION OF DST INDEX

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The first study presents the recent results of our calculations of the solar wind energy input rate to the magnetospheric ring current and simulation of Dst index during the last two solar cycles The second presentation is devoted to equatorial ionosphere dynamics during geomagnetic storms of Western Pacific Ionosphere Campaign (1998 - 1999) observations

RELATIONSHIP BETWEEN LARGE-SCALE FAC AND SOLAR WIND AND INTERPLANETARY MAGNETIC FIELD PARAMETERS – MODEL AND OBSERVATION

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In this paper satellite data on polar cap (PC), Region 1 and Region 2 FAC systems under various solar wind (SW) and interplanetary magnetic field (IMF) conditions are compared with a model of large-scale field-aligned current (FAC) that has been elaborated recently (Nenovski, 2008). This physically grounded FAC model is based on a non-linear structural interaction of the solar wind with the Earth's magnetosphere. As a consequence, the FAC polarity and intensity distribution has been quantified (parameterized) as a function of the SW velocity and density and the IMF components that enter as input parameters. Besides, there are parameters intrinsic to the Earth's magnetosphere only such as the size of the polar cap and the boundary regions and their plasma density ratio. Coincidence and non-coincidence between experimental FAC structures and the proposed physical FAC model are reported. Factors resulting to such a non-coincidence are suggested and advanced to be taken into account in the proposed large-scale FAC model.

Heliosphere and Cosmic Rays

ON THE PROBABILITY OF SOLAR COSMIC RAY FLUENCY DURING SEP EVENT IN DEPENDENCE OF THE LEVEL OF SOLAR ACTIVITY

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Observational data on cosmic ray fluency in the space near the Earth accumulated by ground and space CR observatories during last decades present unique possibility to estimate statistical properties real of the space radiation and its sensitivity to solar activity. This information on fluency distribution is necessary for estimation of radiation hazard both in the space (satellites, interplanetary missions, space stations) and in atmosphere (aircraft level).

For this aims we study the probability of difference fluency levels of solar cosmic ray in different phases of solar activity. We estimated probabilities of fluencies on the base of long time observation of proton flux (both direct measurements on the space detectors and on the base of recalculation from ground stations). Restored amplitude-frequency spectrum (distribution of events with given interval of amplitudes of the fluency or for fluencies more than given) allows to us estimate probability of dangerous states and extrapolate this distribution to rare events of extremely high amplitudes. These result allow to estimate radiation dangerous level both for long term missions in far space and for short time expeditions in near space for different states of solar activity

Main source of data for this analysis is data from the Catalog of Shea and Smart for 31 year observations' fluency in space (1990) and for detailed analysis – data from satellites GOES during the last 11 last years (1994–2004).

INVERSE PROBLEMS FOR GREAT SEP: MONITORING BY NETWORK STATIONS AND FORECASTING

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It is well known that energy spectrum of solar energetic particles (SEP), observed by ground based neutron monitors and muon telescopes (in high energy region; the transfer to the space from the ground observations is made by the method of coupling functions, see in [1], Chapter 3), and by detectors on satellites and space-probes (in small energy region) changed with time very much (usually from very hard at the beginning of event to very soft at the end of event). The observed spectrum of SEP and its change with time is determined by three main parameters: energy spectrum in source, time of ejection, and propagation mode. In the past we considered the first step for forecasting of radiation hazard: the simple isotropic mode of SEP propagation in the interplanetary space [2]. It was shown that on the basis of observation data at several moments of time could be solved the inverse problem and determined energy spectrum in source, time of ejection, and diffusion coefficient in dependence of energy and distance from the Sun. Here we consider the inverse problem for the complicated case: mode of anisotropic diffusion and kinetic approach. We show that in this case also the inverse problem can be solved, but it needs NM data at least at several locations on the Earth. We show that in this case the solution of inverse problem starts to work well sufficiently earlier than solution for isotropic diffusion, but after 20-25 minutes both solutions give about the same results. It is important that obtained results and reality of used model can be controlled by independent data on SEP energy spectrum in other moments of time (does not used at solving of inverse problem). On the basis of obtained results can be estimate the total release energy in the SEP event and radiation environment in the inner Heliosphere, in the magnetosphere, and atmosphere of the Earth during SEP event.

[1]. L.I. Dorman, Cosmic Rays in the Earth's Atmosphere and Underground, Kluwer Academic Publ., Dordrecht/Boston/London, 2004.

[2]. L.I. Dorman, Cosmic Ray Interactions, Propagation, and Acceleration in Space Plasmas, Springer, Netherlands, 2006

THE GREET FORBUSH EFFECTS ACCORDING TO OBSERVATIONS ON MT. HERMON IN NEUTRON TOTAL COMPONENT AND IN DIFFERENT MULTIPLICITIES

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We investigate great Forbush effects (including the biggest in 2003) observed by NM of Emilio Segre' Observatory on Mt. Hermon in neutron total component (more than 15%) and in different multiplicities. On the basis of these data we determine rigidity spectrum of cosmic ray intensity decrease, effect of pre-increase, and estimate properties of interplanetary shock wave and moving magnetic trap caused observed giant Forbush effects in cosmic rays. We compare obtained data with results of observations on other sites on the Earth and on satellites.

COSMIC RAYS AND SPACE WEATHER EFFECTS: METHODS OF FORECASTING

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This report based on many original papers of author and his colleagues on the using of cosmic rays (CR) for continue monitoring and forecasting of great natural hazards for people and technologies from space weather effects. It consists from 5 parts.

Part 1. Cosmic rays and space weather influence on global climate change (determining of the part of global climate change caused by the long-term change of CR intensity through influence on air ionization and planetary clouds formation; examples from the past; method of forecasting of the part of global climate change caused by space weather effects).

Part 2. Global natural disaster from great magnetic storms connected with big CR Forbush-decreases and their assessment by using world-wide network of CR stations. We show that by using on-line one hour CR data from world-wide network of stations is possible to made exact assessment of this natural hazard for 15-20 hours before of the storm sudden commencement.

Part 3. Global natural disaster from great intense radiation hazards for astronauts, crew and passengers on regular airline flights (on the standard altitude about 10 km), and some time for people on the ground due to great solar flare CR events (statistical distribution, examples from the past). We show that this advertisement, with high occurrence probability, can be given 30-60 minutes before the arrival of the more dangerous particle flux.

Part 4. Prediction of the interaction of a dust-molecular cloud with the solar system by measurements of changes in the galactic CR distribution function. From the past we know that the dust from clouds between the Sun and the Earth leads to decrease of solar irradiation flux with sufficient decreasing of global planetary temperature (on 5-7° in comparison with 0.8° from green effect).

Part 5. Prediction of the radiation hazard produced by CR particles generated in a nearby Supernova explosion (SE). We estimate the probability of Supernova explosions inside different distances from the Sun and expected radiation hazard, and its variation with time. We show that by high energy CR measurements will be obtain information on the source function and diffusion coefficient for many years before when real radiation hazard will be formatted on the Earth. On the basis of this information we can made exact forecasting on developing in time of the radiation hazard in space and in the atmosphere on different altitudes and cutoff rigidities by using method of coupling functions, and experts must to decide how to prevent the Earth`s civilization.

References:

Lev I. Dorman `Cosmic Rays in the Earth`s Atmosphere and Underground`, Kluwer Academic Publishers, Dordrecht/Boston/London, 2004.

Lev I. Dorman `Cosmic Ray Interactions, Propagation, and Acceleration in Space Plasmas`, Springer, Netherlands, 2006.

Lev I. Dorman "Cosmic Rays, Plasmas and Energetic Particles in Planetary Magnetospheres", Springer, Netherlands, 2008 (in print)

CORRECTION OF OBSERVATIONS IN CALCULATION OF HELIOSPHERIC MAGNETIC FIELDS FROM SOLAR MAGNETOGRAPH DATA

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Nature of the discovered difference between histograms of distribution of daily-averaged values of magnetic field in heliosphere near the Earth and in the Sun on the source surface is discussed. Values of magnetic field measured near the Earth are a bit less than the calculated ones and give a two peaks distribution. A new method of correction taking into account saturation of magnetographs and contribution of high-latitude fields is proposed. Carried out by this method calculations are in better accordance with observations

HYBRID PARTICLE-DETECTOR NETWORK LOCATED AT MIDDLE-LOW LATITUDES FOR SOLAR PHYSICS AND SPACE WEATHER RESEARCH

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A network of middle to low latitude particle detectors called SEVAN (Space Environmental Viewing and Analysis Network) is planned in the framework of the International Heliophysical Year (IHY), to improve fundamental research of the Solar accelerators and Space Weather conditions. The network will detect changing fluxes of the most of species secondary cosmic rays at different altitudes, latitudes and altitudes those constituting powerful integrated device in exploration of solar modulation effects.

Surface particle detectors measure time series of secondary particles born in cascades originated in the atmosphere by nuclear interactions of the "primary" protons and nuclei accelerated in galaxy. During violent solar explosions sometimes additional particles, accelerated at sun's environments, are added to this "background" flux. If solar particles are energetic enough they also will generate secondary particles reaching earth surface. Therefore, registration of changing time series of secondary particles shed light on the high-energy particle acceleration mechanisms by solar flares and Coronal Mass Ejection driven shocks. Network of particle detectors located at middle-to-low latitudes is sensitive to the highest energy solar particles. The enigma of particle acceleration in supernovae remnants, super-massive black holes, clusters of galaxies can be researched using particle beams accelerated by sun and detected at earth. The shock acceleration is a universal process responsible for the same physical process (particle acceleration) on the different scales.

Time series of intensities of high energy particles can also provide highly cost-effective information on the key characteristics of the disturbances of interplanetary magnetic field.

Recent results on of the detection of the extreme solar events (2003, 2005) by the monitors of the Aragats Space-Environmental Center (ASEC) illustrate wide possibilities opening with introduction of new particle detectors measuring neutron, electron and muon fluxes with inherent correlations.

One of the major advantages of multi-particle detectors is probing of the different populations of the primary cosmic rays, initiated particle cascades in terrestrial atmosphere. With basic detector of SEVAN network we are measuring fluxes of neutrons and gammas, of low energy charged component and high energy muons. This diversity of information obtained from SEVAN network located mostly at low and middle latitudes will give possibility to estimate the energy spectra of the highest energy SCR. SEVAN

network will be sensitive to very weak fluxes of SCR above 10 GeV, very poorly explored highest energy region.

First modules of SEVAN network are in operation in Armenia, in 2008 we plan to install additional modules in Croatia, Bulgaria and India, in 2009 in Costa Rica, Indonesia and Slovakia.

SURFACE PARTICLE DETECTORS IN SPACE WEATHER FORECAST

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Recently several groups report on the development of the alarm system based on the surface particle detector data. Among them are high-latitude neutron monitors network "Spaceship Earth", coordinated by the group from Bartol Research Center; Muon network coordinated by the group from Shinshu University and Athens Neutron Monitor Data Processing Center.

In the presented report, based on the information content of data from particle detectors of Aragats Space Environmental Center (ASEC) we made attempt to review possibility of surface particle detectors in Space Weather forecasts.

Forecasting of the Solar Energetic Proton (SEP) events by surface particle detectors is based on the detection of the Ground Level Enhancements (GLE). Unfortunately not all SEPs contain particles energetic enough to produce GLE, therefore, the efficiency of the warnings will not be very high. Nonetheless, we can expect that the major events, (like 1859, 1956, 1972, 1989) with high probability will generate GLEs and surface detectors can provide forewarnings on upcoming abundant SEP particles. With the exception of the event on 20 January, when due to very good magnetic connection of the flare site with earth, all relativistic particles seem to come simultaneously, the enhancements of GeV solar particles detected by the Neutron Monitors can alert on upcoming severe radiation storm. The alerts from middle and low latitude monitors are even more important compared to high latitude networks, because of lower probability of false alarms. If an enhancement occurs at monitors with large cutoff rigidity it indicates that spectral knee occurs at large enough energy. Enhancements in the ASEC detectors count rates indicate higher solar ion energies, and, consequently hard spectra of the GLE in progress.

The triggers of the Geomagnetic Storms are huge magnetized clouds (Coronal mass ejections – CMEs), emitted by sun and traveling in the Interplanetary Space (IP). This gigantic plasma clouds with "frozen" magnetic field (Interplanetary CMEs, - ICMEs) disturb the Interplanetary Magnetic Field and "modulate "the ambient flux of the Galactic Cosmic rays (GCR). On the way to Earth (15 – 70 hours) the magnetic cloud and shock modulate the GCR flux, changing its intensity and making it anisotropic. The strength of these modulation effects correlate with geomagnetic indices of the geomagnetic storm. Networks of the particle detectors located on Earth surface detect these modulation effects and can predict the upcoming geomagnetic storms hours before the ICME arrival at the magnetometers on ACE and SOHO space stations.

We will demonstrate that simultaneously detection of the charged and neutral components of the secondary cosmic rays made by ASEC monitors enlarged possibilities of physical inference on the solar modulation effects and, therefore, enlarges possibilities of timely and reliable forecasts of dangerous consequences of radiation and geomagnetic storms.

CHARACTERISTICS OF THE PARTICLE DETECTORS OF THE SPACE ENVIRONMENTAL VIEWING AND ANALYSIS NETWORK (SEVAN)

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One of the major advantages of particle detectors measuring both charged and neutral secondary cosmic rays is probing of the different populations of the primary flux incident on terrestrial atmosphere. With SEVAN network we are measuring fluxes of neutrons and gammas, of low energy charged component and high energy muons. This diversity of information will give possibility to investigate in details solar modulation effects and issue warning and alerts ion dangerous consequences of Space Weather.

To understand sensitivity of new type of particle detectors to highest energy solar ions we investigate the response of SEVAN basic units to galactic and solar protons. Methods of estimation of the index of power spectra of solar cosmic rays incident on the terrestrial atmosphere and – for the distinguishing of the ground level enhancements initiated by solar neutrons also are proposed.

First modules of the SEVAN network are in operation in Nor Amberd research station of Yerevan Physics Institute at altitude 2000 m and in Yerevan headquarters at altitude 1000 m. The count rates of the charged and neutral components of the secondary cosmic rays are registered starting from January 2008, thus comprising benchmark measurements (at minimal solar activity) of starting 24-th solar activity cycle. The comparisons of registered count rates with simulations are performed and presented.

THE INVESTIGATIONS OF THE SOLAR WIND WITH THE LARGE DECAMETRIC RADIO TELESCOPES OF UKRAINE

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The solar wind study is one of priority task of the low frequency radio astronomy. Interplanetary scintillation (IPS) method is known to be a powerful tool for studing the interplanetary medium. The experiments at meter wavelengths and shorter ones have allowed the large amount of new data on the structure and the dynamic of the interplanetary plasma in the inner heliosphere to be obtained. Decametric range has been used less actively, but it enables us to study the outer heliosphere at the large distances from the Sun. The outer heliosphere has been investigated by satellites, but deep space missions have been rare enough.

The first use of the IPS method based on the analysis of scintillation spectra and observations were carried out with one radio telescope. Model fitting allowed the parameters both of slow and fast solar wind to be estimated. The further progress in this field is connected with using the methods of the dispersion and tomographic analyses. These methods are based on simultaneous observations of scintillations in spatially separated points. The tomographic analysis enables complete reconstruction of the form and dynamic of transient phenomena to be carried out and, first of all, coronal mass ejections (CMEs). It weakly depends on model of medium, but needs a large number of sounding radio sources. It is difficult to satisfy this requirement in the decametric range because of the high level of background. This limits observation sensitivity and, correspondingly, the number of acceptable sources.

In our talk we discuss the effectivity of the method of the dispersion analysis using observations of the interplanetary scintillation in two spatially separated points (decametric radio telescopes UTR-2 and URAN-2). Joint analysis of the dispersion of velocities and scintillation spectra allows the principal parameters of the interplanetary plasma along the line of sight to be determined. Using layered medium model it is possible to evaluate layer widths, their density, velocities, power of spatial spectrum and inner scales of interplanetary turbulence.

STUDY OF THE LONG -TERM VARIABILITY OF INTERPLANETARY PARAMETERS AS A LINK FOR SOLAR-TERRESTRIAL RELATIONSHIPS

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Often the interplanetary parameters used for the study of solar-terrestrial relationships are solar wind speed (V), the total interplanetary magnetic field (B) and the southward component of IMF (Bz) measured by satellites and space probes. Both, hourly and daily values of these parameters have usually been employed to associate with parameters defining terrestrial effects. On a day-to-day basis, the product VB has recently been reported to be the most effective parameter yielding the highest correlation with cosmic rays and geomagnetic indices, even though earlier studies had

either advocated for V, or some other combinations of various interplanetary indices. Moreover, it has been suggested that the degree of relationship differ for different phases of the solar activity cycle, and also from one cycle to another. As such, we have used the daily values of interplanetary indices (V, B and Bz), as well as the daily values of the geomagnetic disturbance index Ap, for a fairly long period of time from the year 1965 to 2006, covering almost four solar cycles (20, 21, 22 and 23). The long-term averages have been calculated for the days when simultaneous data is available for all the four parameters (V, B, Bz and Ap). Their yearly averages as well as averages on the basis of the phases of the solar activity cycle (such as minimum activity, ascending, maximum, and descending phase) have been obtained. The cross-correlations between them have been investigated on these long-term averages, as well as on the day-to-day basis. These sets have been further divided and studied on the basis of days with Bz being ≤ 0, or $Bz > 0$. The results so obtained can be summarized as: (1) the magnitudes of the values of Ap are observed to be always enhanced significantly for the case of $Bz \leq 0$, as compared to days with $Bz > 0$, (ii) V vs Ap has always low values of correlation coefficient (r) both on the average basis, as well as on a day- to- day basis. (iii) on the contrary, B vs Ap has high values of 'r' both on a day-to-day basis, as well as on an average basis, (iv) nevertheless, the product VB vs Ap always yields much better correlations than for V or B, either on an average basis, or on a day- to- day basis, and (v) eventhough, the long-term variations of V are not very significant, the variation of B follows solar activity cycle and has a continuously increasing trend during the solar cycle 20 and 21. These conclusions will be discussed on the basis of the results reported earlier and on the basis of the theoretical models.

ELECTRONICS FOR THE SPACE ENVIRONMENTAL VIEWING AND ANALYSIS NETWORK (SEVAN)

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A network of particle detectors called SEVAN (Space Environmental Viewing and Analysis Network) is planned in the framework of the International Heliophysical Year (IHY), to improve fundamental research of the solar accelerators and space weather conditions.

Data Acquisition electronics implementing registration of the charged and neutral fluxes of secondary cosmic rays consists of 8-Channel Discriminator/Counter Unit (8DCU) and 3 High Voltage supplies with presetting and automatic control, which are located in the corresponding PMT cases.

8DCU parts are:

- The 8-channel Programmable Threshold Comparator and Counter board (8CNT)
- Universal RS232/RS485 interface/power supply module - IFCC,
- Power transformer - 220V50Hz to 2x8V 0.5A + 2x15V 1.25A

The main features used in 8DCU are:

- 8 programmable threshold analog input,
- Threshold programming range 4mV-1000mV with 4mV step,
- Powered by AC 50-60Hz 220V, 30W
- Maximal counting frequency – 60kHz,
- LEDs to indicate the input pulses in each of 8channels, module power and programmable trigger condition,
- 8 input BNC connectors,

8CNT board is used as a standalone 8-channel counter (scalar) with programmable threshold. For the thresholds programming and the output data readout it can communicate to the host PC (local network) through the IFCC module by any of RS-232 or RS-485 interface ports.

The module counter and interface logic is based on the Atmel AVR Atmega88 8-bit microcontroller.

PARAMETERS OF THE ARAGATS SPACE-ENVIRONMENTAL CENTER MONITORS AS MEASURED AT START OF 24-TH SOLAR CYCLE

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Particle monitors located at Aragats Space Environmental Center (ASEC) at altitudes of 1000, 2000 and 3200 m above sea level and geographical coordinates (40°25′N, 44°15′E); Vertical cut-off rigidity in 2007: 7.1 GV, detect charged and neutral components of the secondary cosmic rays with different energy thresholds and various angles of incidence. ASEC monitors were equipped with new DAQ electronics and software significantly enlarging information content of collected data. At the start of the 24-th Solar Cycle in beginning of 2008 it was necessary to measure and calculate main parameters of ASEC monitors. Among them are:

- Barometric coefficients for different dead times neutron monitors electronics and for different energy threshold of muon scintillation detectors;
- Energy thresholds of the Nor Amberd Multidirectionsl Muon Monitor and SEVAN detectors;
- Multiplication coefficients of the evaporated neutrons for Aragats and Nor Amberd neutron monitors;
- Count rates of all ~200 measuring channels of ASEC;
- Count rates of different coincidences, corresponding to various angles of incindence of the secondary particles.

All these parameters measured at minimal Solar Activity will comprise a benchmark for further physical analysis of solar modulation events (Ground Level Enhancements, Geomagnetic storms, Forbush decreases) expected during 24th solar cycle).

ON THE POSSIBILITY TO MODERNIZE EXISTENT NETWORK OF NEUTRON MONITORS

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Despite decades of tradition, Neutron Monitors (NM) remain the state-of-the-art instrumentation for measuring spectral variations in the energy range from about 500 MeV to 20 GeV of the primary cosmic ray component (above the Earth`s atmosphere). The worldwide network presently consists of about ~50 standardized IGY and NM64 neutron monitors.

We propose an update of this network by introducing new detectors and new electronics to be added to existing detectors, significantly enlarging its performance for solar physics and Space Weather research.

We propose to locate scintillation detectors above and below (if construction of NM allows) the standard sections of NM. New scintillator detectors of size 1 x 1 x 0.01 m3 produced by the Institute of High Energy Physics, Protvino, Russia are compact and provide uniformity light collection. Measuring both neutral and charged flux of the secondary cosmic rays will allow to:

- Significantly enlarge the count rate of detector; note that flux of low energy charged particles is ~10 times higher than neutron flux;
- Explore more energetic population of the primary cosmic rays, giving possibility to estimate spectra of the solar cosmic rays;
- Distinguish Ground level Enhancements originated by solar neutrons;
- Estimate the incident direction of the additional flux of solar cosmic rays.

New Data Acquisition (DAQ) electronics will provide also possibility to count total number of the evaporated neutrons originated in lead by hadrons entering NM. Number of neutrons is good proxy of the incident hadron energy.

BAROMETRIC COEFFICIENTS OF THE NEUTRON MONITORS LOCATED AT SLOPES OF MOUNTAIN ARAGATS CORRESPONDING TO THE TIMES OF TERMALIZED NEUTRON COLLECTION

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Neutron monitors located at Aragats Space Environmental Center (ASEC) at altitudes of 2000 and 3200 m above sea level and geographical coordinates (40°25′N, 44°15′E); Vertical cut-off rigidity in 2007: 7.1 GV, are equipped with special electronics allowing to register 3 time series corresponding to different dead times of proportional chambers.

During more than 50-years operation Neutron Monitors (NM) network prove to be extremely effective in observing solar modulation effects. Several attempts were made to enlarge NM information contain: put additional channels without lead coverage, measure so called multiplicity (number of multiple counts), etc… The monitors are equipped with new electronics providing time integration of counts by three dead times. The first dead time equals to 400ns for collecting almost all secondary neutrons generated in the lead of NM. The second dead time is equal to the 0.25ms and the third one equal 1.25ms (as most of NM from world-wide network).

Physical analysis of the 3 time series from one and the same monitor and comparison of data from 2 monitors located at 2 altitudes will be presented in the report. Barometric coefficients of all 6 time series will be calculated and compared. Also information content of the multiplicity and new measured parameters will be performed.

DAILY VARIATION IN INTENSITY OF DIFFERENT SPECIES OF SECONDARY COSMIC RAYS AS MEASURED BY THE PARTICLE DETECTORS OF ARAGATS SPACE ENVIRONMENTAL CENTER AT MINIMUM OF SOLAR ACTIVITY

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We have used data from Aragats Space Environmental Center particle detectors (ASEC) measuring neutron, low energy charged, high energy muon components of secondary cosmic rays at a altitudes (1000, 2000, 3200 m) and under different axes of incidence for precise description of the diurnal variation of CR intensity during minimal disturbance of Interplanetary Magnetic field (IMF) and magnetosphere. After installing new data acquisition electronics and replacement of defected counters operation of ASEC monitors became rather stable. New installed sensors are measuring atmospheric pressure, humidity and temperature are used to obtain correlations of the particle count rates with environmental parameters. Multivariate correlation analysis of all particle fluxes and other relevant information helps to reveal in more details the drivers of diurnal variations. Obtained information will be used for enumeration of solar modulation effects in started 24-th cycle of solar activity.

MUON TELESCOPES AT BASIC ENVIRONMENTAL OBSERVATORY MOUSSALA AND SOUTH-WEST UNIVERSITY - BLAGOEVGRAD

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Two muon telescopes of cubic design are operated at present in Bulgaria for studying the variations of cosmic rays muon flux. A 1m2 telescope is located at BEO - Moussala - 2925 m. a.s.l and is in operation since August 2006. The other muon telescope, with effective area 2.25 m2 is located at the South-West University - Blagoevgrad - 383 m a.s.l. Its data acquisition system was upgraded in November 2007.

Both instruments use developed by our team water cherenkov detectors, which are much more cost effective and easier for production than scintillator or proportional tube detectors used ordinary in muon telescopes.

In this talk the following topics will be presented:

- Description of the instruments (detectors construction and setup, data acquisition system - hardware and software) ;
- Main characteristics of the instruments (energy thresholds, expected and experimental count rates, barometric coefficients) ;
- Response to primary cosmic rays protons - results obtained from simulations with Planetocosmics code ;
- Some experimental results - the Forbush Decrease in November 2003, registered by the muon telescope at the South-West University and the Forbush Decrease in December 2006, registered by the muon telescope at BEO - Moussala.

INTEGRAL COSMIC RAY SPECTRA IN THE PLANETARY ATMOSPHERES IN EXTREME PHASES OF THE SOLAR CYCLE

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The cosmic radiation can induce ionization and excitation of the planetary ionospheres and also nuclear reactions in their deeper atmospheric layers. The contribution of cosmic rays to the ionization of the ionospheres of outer planets will be increased with increase of the planetary distances from the Sun. We propose a model which generalizes the differential D(E) and integral D(>E) spectra of low energy galactic (GCR) and anomalous cosmic rays (ACR) in the planetary atmospheres during the 11-year solar cycle.

The calculated integral model spectra are on the basis on mean gradients: for GCR - 3%/AU (Fuji Z. et al., 1997; Heber B et al., 1995), 7%/AU for anomalous protons (McKibben et al., 1979; Christian et al., 1999), and 8.5%/AU for anomalous helium (McKibben et al., 1985).

The obtained results are compared with experimental data and the model CREME96 for the Earth. The model calculations are compared with Voyager and Pioneer measurements in the outer heliosphere.

We show that in periods of low solar activity and with increase of the planetary distances from the Sun the role of the galactic particle fluxes increases as an ionization factor in the Earth's and planetary environments, affecting the conductivities, electric fields and energetic processes in the ionospheres and atmospheres.

INTERPLANETARY CONDITIONS FOR CIR-, SHEATH- AND ICME-INDUCED MAGNETIC STORMS

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We study large-scale phenomena in the solar wind which are important elements of space weather because they play a clue role in transfer of energy from the Sun to the magnetosphere of the Earth. On the basis of the OMNI database of interplanetary measurements we identified large-scale structures of solar wind (SW types) for all time intervals during 1976–2000. Our classification includes quasi-steady types: (1) Heliospheric current sheet (HCS), (2) Slow and (3) Fast SW streams, respectively, from closed and open magnetic field structures in the solar corona, and disturbed types: (4) Corotating interaction regions (CIR – compressed regions between slow and fast SW streams), (5) Sheath (compressed regions ahead of MC/Ejecta) and (6) Magnetic cloud (MC) and (7) Ejecta as well as (8) direct and (9) reverse interplanetary shocks (see catalogue on site ftp://ftp.iki.rssi.ru/pub/omni/). We discuss several preliminary results obtained with our catalogue (see more details in http://www.iki.rssi.ru./people/yyermol_inf.html) including effects on the Space Weather. In particular, though, on the average, minimum of the Bz -component of IMF are observed in the MC, the minimum of the Dst-index are achieved in the Sheath. Thus, the strongest magnetic storms are induced, on the average, by the Sheath rather than by the MC/ejecta body, probably owing to higher value and variations of pressure and IMF in the Sheath. Preliminary results show that on the average the steepest Dst.vs.Bz dependence is observed in the Sheath, and the steepest Dst.vs.Ey (where Ey is y-component of SW electric field for negative Bz) dependence is observed in the MC. We discuss also variations of yearly occurrence rates of SW types during 2 solar cycles.

Paper is supported in part by Physical Department of Russian Academy of Sciences, Program N 16, Presidium of Russian Academy of Sciences, Program N 16, and by RFBR, grant 07-02-00042.

LEAD FREE NEUTRON MONITOR AT BASIC ENVIRONMENTAL OBSERVATORY MOUSSALA

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The recently developed lead free neutron monitor is presented. The device is devoted for cosmic ray variations studies and space weather studies at Basic Environmental Observatory Moussala. The detector design and corresponding Monte Carlo simulations and methodological measurements are presented. The scientific potential of the existing complex is discussed, precisely the possibility to register solar proton events, ground level enhancements and Forbush decreases. The potential of the device for study of the possible connection between cosmic ray measurements and the environmental parameters, precisely atmospheric ones is widely discussed.

Several recent measurements are shown.The barometric effect is demonstrated. Several connections with environmental processes are described.

SOLAR WIND & INTERPLANETARY MAGNETIC FIELD (IMF)

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The Solar wind magnetic field distribution near the Earth has been studied and compared with the distribution anticipated according to the classical model. It has been indicated that a two-hump distribution of the IMF values discovered previously is not an artifact of averaging but reflects the actual structure of the magnetic field within the sector. In this case the magnetic field of polarity corresponding to the leading spot in the Northern Hemisphere is encountered more frequently. Not only the magnetic field magnitude but also the fields of either polarity increase with increasing activity. The distance between the peaks on the histogram of the magnetic field near the Earth increase from 6 to 10 nT. The quasi -22-year, 11-year, and quasibiennial (2.6 ± 0.3 years) cycles are observed in an alternate increase in the peaks, in the strength of the fields of either polarity, and in the ratio of the peaks to the occurrence frequency of zero values, respectively. The classical model is violated in approximately 25% of cases.

Planetary Ionospheres, Thermospheres and Mesospheres

QUIET-TIME F2-LAYER DISTURBANCES: MORPHOLOGY AND SOME FORMATION MECHANISMS

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Quiet-time F2-layer disturbances (Q-disturbances) is a special class of F2-layer perturbations not related to geomagnetic activity.Their magnitude is comparable to moderate F2-layer storm effects, but their morphology and formation mechanisms are different from usual magnetic storm-induced F2-layer disturbances. The difference is seen in diurnal, seasonal and latitudinal variations for their occurrence. The difference appears in Ne(h) distributions as well. The 2-D (latitude/longitude) pattern of Q-disturbance looks like a planetary wave with a steep front, such a wave existing for 1-3 days. The analysis of Millstone Hill ISR observations for the periods of Q-disturbances has shown that atomic oxygen [O] concentration variations related to neutral gas vertical motion is the main reason of the negative and positive Q-disturbances. Negative Q-disturbances occur under the so called ground state of the thermosphere characterized by very low geomagnetic activity, an unconstrained solar-driven circulation and relatively low atomic oxygen concentration. Positive Q-disturbances are formed under slightly enhanced geomagnetic activity when solar-driven (poleward) thermospheric circulation is damped during daytime hours. The related with this downward gas motion, enriches the thermosphere with atomic oxygen, the latter results in the NmF2 increase. Positive Q-disturbances belong to the same class of events as usual long-duration F2-layer positive disturbances, both are due to the same mechanism – slightly damped solar-driven circulation (decreased downward plasma drift) and an increased atomic oxygen concentration. The mechanism of negative Q-disturbances is essentially different from usual negative F2-layer storms and this exhibits in different hmF2 variations, Ne(h) distributions, annual and latitudinal occurrence frequency variations. The revealed morphological peculiarities of positive and negative Q-disturbances can be explained in the framework of the present day theory of the F2-layer formation.

THE VARIABILITY OF FOF2 IN DIFFERENT PHASES OF SOLAR CYCLE 23

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In this study by using the flare index of the Kandilli observatory, we identified the months with high flare activity during the solar cycle 23. We chose six months which represented the different phases (ascending branch, maximum and descending branch) of the solar cycle. We also took into account the fact that these months were in different seasons. The hourly monthly means of observed foF2 data from four ionosonde stations for six months were calculated. On the other hand the identical foF2 values of the same months were calculated for the year 1996 which is the minimum year of the previous solar activity cycle. The magnitude of the difference with values of this year and the values of the different parts of the last solar cycle were compared. We used IRI-2001 model to see the degree of the deviation from our observed results and predicted ones.

EQUATORIAL IONOSPHERE DYNAMICS DURING GEOMAGNETIC STORMS

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The interplanetary magnetic field, geomagnetic variations, virtual ionosphere height h`F and the critical frequency foF2 data during the geomagnetic storms are studied to demonstrate relationships between these phenomena. We study 5-min ionospheric variations using the first Western Pacific Ionosphere Campaign (1998 - 1999)

observations, 5-min interplanetary magnetic field (IMF) and 5-min auroral electrojets data during a moderate geomagnetic storm. The ionospheric 5-min variations at the equatorial stations which allow calculating in detail time delays of the auroral and equatorial ionospheric phenomena are scantily known. These data allowed us to demonstrate that the auroral and the equatorial ionospheric phenomena are developed practically simultaneously. Hourly average of the ionospheric foF2 and h`F variations at near equatorial stations during a similar storm show the same behavior. We suppouse this is due to interaction between electric fields of the auroral and the equatorial ionosphere during geomagnetic storms. It is shown that the low-latitude ionosphere dynamics during these moderate storms was defined by the southward direction of the Bz-component of the interplanetary magnetic field. A southward IMF produces the Region 1 and Region 2 the field-aligned currents (FAC) and polar electrojet current systems. We assume that the short-term ionospheric variations during geomagnetic storms can be explained mainly by the electric field of the FAC. The electric fields of the field-aligned currents can penetrate throughout the mid-latitude ionosphere to the equator and may serve as a coupling agent between the auroral and the equatorial ionosphere. The storm wind driven electric fields which responsible for the larger amplitudes and longer lifetimes of the drift perturbations are discussed. It is shown that model simulations as disturbed ionospheric wind dynamo d o not allow explaining a significant part of the experimental data. Additional investigations of the ionospheric characteristics are required to clear up the origin of the short-term equatorial ionospheric variations.

STORM SUDDEN COMMENCEMENTS AT INDIAN STATIONS AND ASSOCIATED CHANGES IN INTERPLANETARY MAGNETIC FIELD ORIENTATION

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Storm sudden commencement (SSC) or sudden impulse (SI) is one of the important aspects of solar terrestrial relationships involving solar wind, IMF, magnetosphere, ionosphere and EEJ. The SSCs observed globally everywhere at ground, the amplitude of each SSC and waveform will different and depends on the latitude and also the local time. The understanding of the SCs in general involves the complex current systems that develop in the magnetosphere-ionosphere domain as a result of sudden magnetospheric compression. In recent years, the statistical studies showed the local time (LT) pattern of occurrence of preliminary impulse at middle and low latitudes and associated mechanisms of field aligned currents and ionospheric currents. The objective of this work focuses is on the SSCs chacteristics of severe magnetic storms which occurred during solar cycle 23 and associated IMF parameters and solar wind dynamic pressure will be investigated using digital geomagnetic data from Indian sector and also satellite data. This study will also aim to understand the aspects of preliminary impulse and main impulse characteristics at low latitudes from Indian sector and the associated ionospheric current systems which will be the tool to investigate the coupling between magnetosphere and Ionosphere.

VERY LOW FREQUENCY REMOTE SENSING MEASUREMENTS OF THE LOWER IONOSPHERE AT SITE OF THE UNITED ARAB EMIRATE

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The propose research project is aiming for providing a basis data for quantitative comparison of lightning-induced disturbances of the ionosphere and the radiation belts in the American, European and Asia sectors. Most of the current data on such phenomena has so far been obtained in the western hemisphere, and the weight of scientific information indicates that lightning-induced effects at high altitudes and in the radiation belts may dominate other processes on a global scale. The proposed research project will facilitate the establishment and conduct of Very Low Frequency (VLF) observations in the United Arab Emirate (UAE) as a part of Asia sector, thus providing a basis for comparison to facilitate global extrapolations and conclusions. Under the proposed project, Stanford University partners with Sharjah University, deploying one of their VLF receivers at

Sharjah University campus. Sharjah University provides the data digitization and recording equipment to facilitate continuous acquisition of the data. All data from the proposed project will be available for analysis over the Internet, and a series of annual visits are planned to maximize interactions and information exchange between the two universities.

RESPONSES OF THE IONOSPHERIC SCINTILLATION AND TEC DURING SUNRISE AND SUNSET PERIODS WITHIN EEJ BORDER

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Scintillation Network Decision Aid (SCINDA) is a real-time, data driven, communication outage forecast and alert system. Its purpose is to aid in the specification and prediction of communication degradation due to ionospheric scintillation in the equatorial region of Earth. Ultra high frequency (UHF) and L-band scintillation parameters are measured, modeled and propagated in time to provide a regional specification of the scintillation environment in an effort to mitigate the impacts on the satellite communications community. Equipment at the remote sites record scintillation parameters from available UHF Fleet Satellite Communication System and L-band (Geostationary Operational Environmental Satellite (GOES), GPS) satellite links and measure ionospheric drift velocities. SCINDA consists of a set of ground-based sensors and quasi-empirical models, developed to provide real-time alerts and short-term (< 1 hour) forecasts of scintillation impacts on UHF satellite communication and L-Band GPS signals in the Earth`s equatorial regions. The SCINDA system concept is presently being demonstrated using ten equatorial stations in South America, South Asia and West Africa. Preliminary results of studies of ionospheric scintillations and total electron content within the equatorial electrojet are discussed. We examined the response of the two parameters within the rising and setting hours of the Sun.

LONGITUDINAL DEPENDENCE OF SOLAR QUIET DAILY VARIATION WITHIN ELECTROJET REGION

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MAGDAS, Magnetic Data Acquisition System, is a growing network of more than 30 observatories. MAGDAS was successfully installed at the University of Ilorin, Nigeria – an equatorial station - in August 2006. MAGDAS is a strong component of International Heliophysical Year, IHY. The solar quiet daily variations were evaluated within the equatorial electrojet zone using data from MAGDAS stations located along the electrojet strip. The longitudinal variation of Sq was examined vis-a-vis the seasonal dependence. The results obtained were compared with some past results. Specific contributions of MAGDAS to the understanding of the subject matter are highlighted.

MAPPING REFLECTION OF WORLDWIDE IONOSPHERIC CURRENT USING INTERMAGNET GEOMAGNETIC DATA OVER A SOLAR CYCLE

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The spatial distribution of the daytime and nighttime Solar quiet variation Sq and superposed magnetic field SPMF of the earth have been studied extensively. INTERMAGNET data bank comprises of geomagnetic data contributed from 60- 85 globally distributed observatories. The data set spanned through 1992-2005. Sq and SPMF in HDZ component were examined qualitatively and quantitatively. Spatial distribution in both Sq and SPMF manifest zonal effects dominating at sub-regional sectors and combined to give a global distribution of responsible ionospheric currents. The vertical intensity maximizes around the polar region, while horizontal intensity has primary and secondary maxima at polar and equatorial regions respectively. Declination

component is generally low at the equatorial region. The spatial variation is explicable in terms of local effect such as the dynamics of the aurora and equatorial electrojet and neutral winds. Signature of solar activity is deduced in the variation pattern of Sq and SPMF over the solar cycle.

THE 557.7 NM AIRGLOW VARIATIONS AND ANOMALIES IN THE LOWER ATMOSPHERE AND SURFACE TEMPERATURE

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The interannual [OI] 557.7 nm emission variations correlated with anomalies of the global climatic indexes for lower atmosphere and surface temperature within some years are analyzed. The planetary waves are considered as a channel of the connection between variations of characteristics of the lower atmosphere and the airglow. The interannual variations of the conditions of the occurrence (temperature contrast in the continent - ocean system) and/or the propagation (global or regional atmospheric circulation) of the planetary waves can produce the 557.7 nm airglow interannual variations. In particular as a possible explanation of obtained correlation of the 557.7 nm emission variations and the surface temperature anomalies, there is offered the mechanism based on the experimental fact of existence of quasi-stationary planetary structures at the airglow and on the hypothesis of orography-thermal excitation of planetary waves. According to this mechanism, change of contrast of annual mean temperatures in the continent-ocean system (or within continents) can determine changes in positions (or amplitude) of quasi-stationary planetary structures maxima and cause modulation of the upper atmosphere airglow within fixed longitudinal zone.

SHORT-TERM TEMPORAL VARIATIONS OF IONOSPHERIC PARAMETERS IN THE SIBERIA AND FAR EAST REGION

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Short-term temporal variations of maximum observable frequencies (MOF) of one-skip signals caused by variations of the upper ionosphere parameters have been studied. MOF data have been received on the Magadan-Irkutsk oblique-incidence sounding path in the period from 9 to 19 November 2005. The analysis was performed by the technique and algorithm, which were developed in ISTP RAS, for determining periodicities in temporal series. The running mode of processing was used to determine periodicities over certain temporal intervals (about tens of minutes, hours).

Spectral power increases on the periods of 1 and 2 hours for separate days of the considered temporal interval were revealed. This spectral power increases can be interpreted as manifestation of the traveling ionospheric disturbances connected with internal gravity waves propagation in the ionosphere.

Probable causes of the revealed variations in ionospheric parameters including those of meteorological origin were discussed.

BEHAVIOR OF THE 557.7 EMISSION IN MLT REGION DURING STRATOSPHERIC WARNING EVENTS

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We investigate the influence of stratospheric warming on the 557.7 nm airglow variations on the basis of the experimental data received at the ISTP SB RAS Geophysical observatory (52N, 103E) in 1998-2008 at different levels of solar activity. The 557.7 nm airglow is emitted at mesosphere–low thermosphere (MLT) heights. In the researched period some cases of abnormal behavior of 557.7nm airglow intensity in absence of strong geomagnetic disturbances have been found out. We revealed, that these significant increasing of the 557.7nm airglow intensity events are caused by strong stratospheric warming when disturbances cover the large range of atmosphere heights. It is emphasized, that for the Asian region, and, in particular, for the region of Eastern

Siberia, there is a big concentration of stratospheric warming centers that can result in occurring regional features in airglow characteristics.

VARIATIONS OF 557.7 NM AND 630 NM ATMOSPHERIC EMISSIONS IN THE 23-RD SOLAR CYCLE

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We present the preliminary analysis of experimental data of nightglow observation of the atomic oxygen 557.7 nm (emitting layer height is 85-115 km) and 630 nm (180 - 250 km) lines emissions in the 23-d solar cycle. The experimental data were obtained at ISTP Geophysical observatory near Irkutsk (Russia) and Stara Zagora (Bulgaria). The 557.7 nm and 630 nm emissions observational data are compared with atmospheric, solar and geophysical parameters. Generally, the 630 nm emission intensity in 23-rd solar cycle changed in a phase with a solar cycle, increasing from the period of low solar activity by the period of high solar activity. As for 557.7 nm emission, the difference of correlation coefficient between its intensity and F10.7 solar radio flux in various phases of 23-d solar cycle was marked. During the increasing and maximum phases the negative correlation between monthly mean 557.7 nm emission intensity and the F10.7 was revealed. Correlation became positive during the descending phase.

Infringement of phase synchronism of 557.7 nm emission behaviour and $F_{10.7}$ during the growth and maximum phase of solar cycle is preliminary interpreted by high sensitivity of atmospheric parameters determining the 557.7 nm emission intensity to atmospheric dynamics and various disturbances including the effects from lower atmospheric layers.

This work was supported by RAS Presidium Program №16 (Part 3) and by the Russian-Bulgarian project ("Atmos").

3D EMPIRICAL MODEL OF TOPSIDE IONOSPHERE AT MID AND LOW LATITUDES DURING SOLAR MINIMUM CONDITIONS

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DEMETER satellite had been launched on June 29 2004 onto near circular sun-synchronous orbit at an average altitude of 730 km in 1030-2230 LT orbital plane. Onboard instrumentation is addressed to the global monitoring of the seismic and natural disaster effects in the Earth`s topside ionosphere. A set of plasma probe instruments provide continuous set of data from, AC/DC electric field, ion drift, ion temperature, ion density irregularities within ±60є geographic latitudes. During the period of operation of DEMETER satellite, DMSP-F15 satellite mission as a part of Defence Meteorological Satellite Program was active, which provides by SSIES instrument the ionospheric plasma diagnostics at 840km average altitude in the orbital plane 0930-2130 LT. Ionospheric plasma behavior at given altitude within 730km to 840km layer of low latitude ionosphere was a subject of a 3D empirical model based on statistically obtained values from one month period of experimental data during one year period of low solar activity from Summer 2004 to Summer 2005. Longitudinal distribution of main ionospheric parameters at selected near solstice and equinox conditions by use of model and experimental data from both satellites are shown.

STUDY ON SOLAR SOURCES AND THEIR EFFECTS ON IONOSPHERE AND GEOMAGNETIC FIELD

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Particularly intense events on the Sun occurred during cycle 23. We investigated the characteristics of these events and the properties of the correlated observations of ionospheric absorption, of the critical frequency of the ionospheric F2 layer and of geomagnetic activity at the ground level. Solar events are studied using the characteristics of CME and the temporal evolution of solar energetic particles in different energy ranges.

We have tried to determine: possible clues that could allow a forecast evaluation of the effects produced at the Earth's orbit by the interplanetary perturbations and as these effects are observed on the ionosphere and on the geomagnetic field, using some Antarctic observations.

STUDY OF A GEOMAGNETIC STORM AND A POLAR CAP ABSORPTION EVENT RECORDED ON JANUARY 2005 AT MARIO ZUCCHELLI STATION, ANTARCTICA

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Geomagnetic storms and a polar cap absorption (PCA) event during January 2005 were observed; the events were recorded in Antarctica at Mario Zucchelli Station (geographic coordinates: 74.7ºS, 164.1ºE) by means of different instruments and here briefly discussed. In particular in this work we will present the analysis of geomagnetic data, acquired by a flux-gate magnetometer, and ionospheric absorption data coming from a 30 MHz riometer.

During this period six solar flares of X class, three major geomagnetic storms, a solar proton event and a Polar Cap Absorption were detected. In particular, the very energetic proton event occurring on January 20th, turned up to be the most important event of solar cycle 23 with the highest flux level ever observed since October 1989.

THE AURORAL EMISSIONS AND ELECTRON PRECIPITATION IN THE NORTERN POLAR OVAL NEARLY THE SOLAR CYCLE MINIMUM

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The auroral 5577 E and 6300 E emissions during the 2006/2007 season have been studied by data from the All-Sky Imager (ASI) at Andшya Rocket Range (ARR), Andenes, Norway (69.3°N, 16.03°E). Simultaneously registered absorption images and keograms, presenting the activity in the energetic particle precipitation over a large area of the ionosphere, are looked at. Measurements of the ALOMAR Imaging Riometer for Ionospheric Studies (AIRIS) at ARR, Andenes, Norway, and the Imaging Riometer for Ionospheric Studies (IRIS) at Kilpisjдrvi, Finland (69.05°N, 20.79°E) have been used. The dynamics of the optical emissions and the absorption features has been examined. A good correlation between the spatial and temporal evolutions of the optical emissions and the precipitating electron fluxes has been observed. The solar wind parameters, the Interplanetary Magnetic Field and the geomagnetic activity indices data have been used in order to trace the response of the ionosphere to the solar and geomagnetic activity changes. Analysis of the data is performed to look for the relations between the different processes.

Data access has been provided under the Project "ALOMAR eARI" (RITA-CT-2003-506208), Andenes, Norway. This Project received research funding from the European Community's 6th Framework Program.

EQUATORIAL SPREAD F

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Ionospheric irregularities are temporal and spatial variations of the electron density lasting from a couple of minutes to a few hours. These irregularities in the low latitudes of the F – region of the Ionosphere are called Equatorial Spread F (ESF).

This research involves a case study of Equatorial Spread F at Ho Chi Minh City, Vietnam (10.5 N, 106.3 E, Dip lat. 2.9 N) using ionosonde data obtained during the period 2002 – 2006.

Also, effects of geomagnetic storms in the Ionospheric F – region are important space weather issues. We will present some results of a study of longitudinal differences in the ESF characteristics during the major geomagnetic storm of October 2003.

MOVEMENT OF SATELLITES SET AS THE INDICATOR OF INFLUENCE OF SOLAR AND GEOMAGNETIC ACTIVITY ON THE EARTH UPPER ATMOSPHERE

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The aerodynamic drag is the important perturbing force determining movement of satellites on low Earth orbits. However, due to its nature, it is works constantly and is the reason of satellite energy dissipation, decrease of its altitude and, at last, decay.

The determining physical factor of aerodynamic drag are the variations of average neutral density of atmosphere at altitude of flight, that entails change of drag force and speeds of the satellite. The local atmospheric temperature and density are strongly driven by space weather - solar ultraviolet radiation, coronal mass ejections and other processes which may lead to geomagnetic storms and heating of the upper atmosphere.

Quality of existing atmospheric dynamic models is not satisfactory. The orbit determination accuracy and the forecast of movement, lifetime and moment of decay is currently limited by the accuracy of the atmospheric drag models and in particular the modeling of space weather effects on neutral density.

This paper gives the analysis of the observable facts concerning the changes in the set of different satellites orbits that are caused by changes in the density of the neutral component of the Earth`s atmosphere at the appropriate altitudes. The opportunity of study of spatial distribution of the atmosphere disturbances is analysed using tracking data during recession and minimum of solar activity. The performance of current upper atmosphere models and opportunities of their perfection is discussed.

INDUCED IONIZATION BY SOLAR COSMIC RAYS IN THE EARTH IONOSPHERE

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An improved analytical and numerical model of the electron production rate q (cm-3s-1) from solar cosmic rays with charge Z in the Earth atmosphere and ionosphere is created. A two energy interval approximation of the ionization losses function (dE/dh) is introduced. It performs better approximation of the measurements and experimental data in comparison with previous results. An intermediate transition region between the intervals is used for their coupling on the traveling substance path during the cosmic ray (CR) penetration in the middle atmosphere. The ionization profiles are calculated on the PC with application of the Romberg extrapolation method. They are compared with experimental data. The contributions of the energy intervals from the solar CR differential spectrum are estimated. Different groups of CR nuclei are considered: protons p, a - particles (He nuclei), medium (M nuclei) etc. A new third energy interval for charge decrease in lower energies is taken into account. The atmospheric cut-offs and the geomagnetic cut-off rigidities are included and computed. The energy transformation of

CR in the middle atmosphere is calculated. Vertical CR penetration is assumed in the presented model.

This model is applied for calculation of q(h) profiles by solar cosmic rays in upper atmosphere. The ionization rates are obtained for different cases following given solar CR spectrum. Several major solar proton events (20 January 2005, 23 February 1956 and other) and their effects on the Earth environment are studied.

These results are compared with the simulations of the recent nuclear physics model for evaluation of solar cosmic ray induced ionization in the atmosphere. Our computations carried out with CORSIKA 6.52 code using FLUKA 2006 and QGSJET II hadronic interaction models, precisely the energy deposit of CR induced air showers, are described. On the basis of the computational results the ionization yield function Y and the ion pair production q(h) in the atmosphere for above mentioned solar proton events are presented.

A good coincidence between the theoretical and the nuclear models is obtained.

OBSERVATIONS OF THE ATMOSPHERIC OZONE, PBL AEROSOL STRUCTURE AND METEOROLOGICAL PARAMETERS DURING THE SOLAR ECLIPSE OF MARCH 29, 2006 IN BULGARIA

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In this paper we present the surface and total ozone variations, meteorological parameters and PBL aerosol structure, all measured in Sofia and Stara Zagora, Bulgaria during the solar eclipse of March 29, 2006. Our previous investigations during the solar eclipses of August 11, 1999 and October 3, 2005 demonstrated the influence of the solar eclipse on the meteorological variables, the surface and total ozone concentration and the height of the mixing layer at clear sky. In the present case, there were clouds over Sofia and additional attenuation of the sun radiation influencing on observations. Nevertheless it was observed that the solar eclipse affects PBL development, surface ozone behaviour and the values of the meteorological parameters - air temperature, relative humidity and wind velocity.

Observations were realized at two sites in Sofia - Institute of Electronics and Astronomical Observatory and at STIL-BAS, Stara Zagora. For the measurements we used an aerosol LIDAR, two ozonometers, a meteorological station and a scanning ultraviolet spectrophotometer. The height of the mixing layer, defined by the LIDAR data, was compared with the Whiteman and McKee model simulation.

In Stara Zagora the total ozone content (TOC) behaviour was determined from measured direct solar spectra. The TOC variability during the eclipse of March 29, 2006 and of August 11, 1999 showed almost the same time-patterns features during both eclipses. After the first contact TOC began to decrease till the maximum solar obscuration. In both cases two maxima on either side of the totality were also found.

This study shows that it seems during eclipse at weak developed mixing layer the surface ozone behaviour is mainly defined by photochemical processes.

THE OBSERVATIONAL FEATURES OF THE NOVEMBER 7 – 10, 2004 GEOSPACE SUPERSTORM IN THE LOWER IONOSPHERE

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The goal of this talk is to present the joint analysis of the magnetic measurements and the variations in lower ionospheric parameters obtained by the Kharkiv MF radar during the November 7 – 10, 2004 Geospace Superstorm.

The kinetic and electromagnetic energy inputs to the ionosphere during the magnetic disturbances are estimated, and the features of the development of this magnetic storm in the mid-latitude lower ionosphere are revealed.

During geomagnetic field bursts on magnetically disturbed days, the analysis of time variations in the electron density at a few altitudes has detected an increase of 50–100% in mean values and by a factor of 3–5 in excursions. The relative amplitudes of the 5–180-min period wave disturbances during the storm period are usually equal to 0.05–0.15. A small increase in their values during the second magnetic disturbance on

November 10, 2004 has been detected. No distinct relation between magnetic activity levels and wave disturbance parameters in the lower ionosphere has been found.

A considerable (by an order of magnitude and more) increase in the amplitude and the standard deviation of the magnetic field horizontal component variations during the magnetically disturbed periods has been registered. The amplitudes of Pc5–6 bursts in the H component reach 30 nT and in the D component attain 50 nT. Over some time intervals, the interrelationships between Pc5–6 pulsations and short-period (5–15 min) wave disturbances in the electron density in the lower ionosphere take place. These interrelationships could be caused both by the stimulation of the quasi-periodic mid-latitude magnetospheric electron precipitation by magnetic pulsations and by the acoustic gravity waves generated in the polar regions and propagating to middle and lower latitudes.

LATITUDINAL IMPACT TO QUASI-ELECTROSTATIC FIELDS AND TO SPATIAL PARAMETERS OF RED SPRITES CREATED ABOVE LIGHTNING DISCHARGES

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Strong quasi-electrostatic fields (QSF) created after positive cloud-to-ground lightning discharges, are presumably responsive for the occurrence of red sprites in the mesosphere by nighttime conditions. Many spatial and temporal characteristics sprite features are not well explained until now. We examine here the lightning-driven QSF depending on a variety of factors, and conditions when these fields are sprite-producing. We theoretically study the role in creation of large QSF of the conductivity anisotropy above ~70 km, and of the orientation of the magnetic field. Our theoretical modeling is based on the Maxwell's equations under quasi-static conditions. The conductivity modification due to electron heating and due to changes of the ionization and attachment rates is taken into account self-consistently with the electric field applied. Two cases are considered, respectively: when the thunderstorm considered is at high-middle, and at equatorial latitudes, respectively. We show that the QSF generated in the lower ionosphere due to a lightning discharge of particular characteristics, is much larger and penetrate much higher at equatorial, than at middle latitudes. This difference is yet better expressed above mesoscale convective systems, where sprite occurrence is more typical, in the case of equatorial latitudes, due to the larger horizontal size of the QSF. Another important feature revealed by us is that the maximum of the QSF at an altitude above ~80 km is considerably shifted from the causative lightning discharge in east-west direction, which may serve as an explanation for the observed large horizontal shift of some sprites from the causative discharge.

INDUCED IONIZATION BY GALACTIC COSMIC RAYS IN THE EARTH ATMOSPHERE AND IONOSPHERE

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In this work we describe recent physical model for evaluation of galactic cosmic ray (CR) induced ionization in the atmosphere. Our simulations carried out with CORSIKA 6.52 code using FLUKA 2006 and QGSJET II hadronic interaction models, precisely the energy deposit of CR induced air showers, are described. On the basis of the computational results the ionization yield function Y and the ion pair production q in the atmosphere are obtained. The impacts of the different shower components: the electromagnetic, muon and hadronic components are estimated. The simulations are carried out with realistic atmospheric model (US Standard Atmosphere) and following steep energy spectrum of primary cosmic rays. The hight profiles of electron production rates q(h) by galactic CR in the ionosphere and atmosphere are obtained. Computations for cosmic ray induced ionization in the atmosphere are made for different values of the solar wind modulation function. A comparison is made between results from CORSIKA 6.52 and from theoretical modeling.

An improved analytical and numerical model of the electron production rate from galactic cosmic rays with charge Z in the Earth atmosphere and ionosphere is created. A

five energy interval approximation of the ionization losses function (dE/dh) is introduced. It performs better approximation of the measurements and experimental data in comparison with previous results. An intermediate transition region between the intervals is used for their coupling on the traveling substance path during the cosmic ray (CR) penetration in the middle atmosphere. The ionization profiles are calculated on the PC with application of the Romberg extrapolation method. They are compared with experimental data. The contributions of the energy intervals from the galactic CR differential spectrum are estimated. Different groups of CR nuclei are considered: protons p, a - particles He, light L, medium M, heavy H and very heavy VH. A new sixth energy interval for charge decrease in lower energies is taken into account. The atmospheric cut-offs and the geomagnetic cut-off rigidities are included and computed. The energy transformation of CR in the middle atmosphere is calculated. Vertical CR penetration is assumed in the presented model.

IONOSPHERIC STORMS ASSOCIATED WITH GEOSPACE STORMS AS OBSERVED WITH THE KHARKIV INCOHERENT SCATTER RADAR

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The Kharkiv incoherent scatter radar (ISR) observed the ionospheric storms associated with the geomagnetic storms of September 25, 1998, March 20–21, 2003, May 29–30, 2003, and November 7–10, 2004.

The magnetic storms of September 25, 1998 and of May 29–30, 2003 had long time intervals (6–9 hours) of high geomagnetic activity (Kp greater than 8), the main phase of the storms developed with Dst index decreasing at a rate of 35 – 65 nT per hour and occurred during the time intervals when the Kharkiv ISR radar was in the midnight-predawn sectors. The accompanying ionospheric storms are characterized by the following disturbances. A decrease by a factor of up to 3–4 in the electron density, an increase of 100–160 km in the F peak altitude, hmF2, nighttime heating of the plasma up to 2400–3200 K, an increase of 200–350 K in the neutral temperature, an increase of no less than 400 km in the thermopause altitude, and the depletion of the relative proton density N(H+)/Ne by more than an order of magnitude during the storm's main phase.

The magnetic storm of March 20–21, 2003 (Kp approximately equal to 5) began at 04:45 UT, the main phase developed with Dst index decreasing at a rate of 5 nT per hour and reaching a minimum of −57 nT at 20:00 UT. The accompanying ionospheric storm had two phases and began with a positive phase. The negative phase occurred under low geomagnetic activity and it was characterized by a depletion in NmF2 by a factor of up to 5, an electron temperature increase of up to 2400–3500 K in the 300–500 km altitude range, and an uplift in the F2 layer by more than 100 km over the March 20–21 night and around sunrise. The reversal of the storm phase occurred over the course of less than an hour near dusk and was, apparently, caused by the passage of a traveling atmospheric disturbance and by a electric field pulse in the ionosphere over Kharkiv when the Ey component changed its direction from westward to eastward and its value evolved from −10 to +15 mV per meter.

The magnetic storms of November 7–10, 2004 was accompanied by a negative ionospheric disturbance, including a decrease in NmF2 by a factor of 6–7 and in the total electron content up to the 1000 km altitude by a factor of 2, an uplift of the F layer by 300 km at night and by 150–180 km in the daytime, nighttime heating of the plasma with an increase in the ion and electron temperatures up to 2000 and 3000 K, respectively, and a decrease in the relative proton density N(H+)/Ne by a factor of up to 3.5. The effects usually observed in the high-latitude ionosphere, including the coherent echoes, are detected during the main phase of the storm.

THE INVESTIGATIONS OF SOLAR ACTIVITY INFLUENCES ON IONOSPHERE IRREGULARITIES IN MIDDLE LATITUDES BY MEANS OF THE RADIO TELESCOPE URAN-4

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The radio astronomical monitoring of ionosphere irregularities is based on observation of cosmic radio sources scintillation. This method has highest sensitivity in a short-wave band. Not many radio telescopes can carry out observation in this band. Some of them are URAN system radio telescopes of National Academy of Science of Ukraine.

Analysis of solar influences on ionosphere irregularities was carried out on the base of observation data obtained on radio telescope URAN-4 (Odessa, Ukraine) during 23 Solar cycle at frequencies of 20 and 25 MHz. Ionosphere irregularities, which are traced on this frequency, have size about 0.1-10km.

Scintillation parameters (scintillation index S4, effective period T, index of the spectrum slope p) were used for investigations of solar events and space weather influences on ionosphere irregularities. Variance analysis results are discussed in this paper.

USE OF SONIFICATION IN THE DETECTION AND ANALYSIS OF PLASMAS BUBBLES AT 21 MHZ

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This research explores sonification as a useful and accepted tool for space-data exploration. Our interest lies in basic scientific analysis of plasmas of the ionosphere, of interplanetary space and of the interstellar medium. These plasmas all contain irregularities. Propagation of electromagnetic waves,like optical or radio waves, through a medium with random fluctuations in refractive index will be initially corrugated. This results in amplitude fluctuations, which in turn leads to phase changes in the wave front (Scheuer 1968), possible to be herd in sonified data. The authors emphasize identifying sonification and mapping of the data, and on using the prototype developed by the authors in 2005 NASA Xsonify as assistive technology to extend science to the visually impaired, as required by the Americans with Disability Act (ADA).

WAVELET ANALYSES OF FLARE INDEX AND FOF2 FOR THE SOLAR CYCLE 23

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A brief description and study of the temporal variability of the solar flare index and daily noon-time values of foF2 over the epoch of 1996-2007 is presented. For ionospheric foF2 data Juliusruh/Rugen (54.6N, Germany) and Grahamstown (33.3S, South Africa) stations values are used to search the periodicities. For this purpose the intermediate-term periodicities in the daily flare index and ionospheric foF2 data were studied using the Fourier and wavelet transforms. The wavelet transform results show that the occurrence of flare index and foF2 powers are highly intermittent in time. Comparison of the Fourier and wavelet transform results has clarified the concordence of different periodicities, as well as the temporal location of their occurrence.

ZONAL FLOWS TURBULENT GENERATION BY SMALL-SCALE DRIFT-ALFVEN MODES IN THE IONOSPHERE

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Generation of large-scale zonal flows and magnetic fields by collisionless electron skin depth-scale drift-Alfven turbulence in the ionospheric plasma is examined. Large-scale perturbations of plasma flow and magnetic field are spontaneously generated by short-scale drift-Alfven wave turbulence via the action of Reynolds stress and electromotive force. For a system containing both skin-scale drift-Alfven waves and large-scale structures, small scales are modulated by the larger scale flow and/or by the perturbed large scale magnetic field. As a result, the propagation of small-scale wave pakets is accompanied by the instability of a low frequency, long wavelength components. The nonlinear growth rate of these interaction is a sensitive function of the wave number of the Alfvenic pump wave. This implies that the instability transfer wave energy from the short wavelength regime of the Alfven wave to the long wavelength regime of the large-scale disturbances. Growth rate depends also on the spectrum width of the pump wave packet and eventually is suppressed as the broadening increases. The results of the theory are applied to the satellite observations of the skin-scale drift-Alfven wavy structures in the auoroal ionosphere and agreement of the scales, frequencies and explains the observed large amplitudes of the waves is showed.

THE MIDLATITUDE D-REGION RESPONSE TO GEOMAGNETIC STORMS

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This presentation is concerned with the variations in the electron number density during geomagnetic storms on July 27, 2004, December 07–08, 2004, December 10–11, 2004, January 17 – 19, 2005, September 11 – 15, 2005, and December 14–15, 2006. The data were obtained with the MF radar at Kharkiv V. Karazin National University Radiophysical Observatory near Kharkiv city (49°38′N, 36°20′E; 66°36.8′ inclination, 6°19.6′ declination, and 156 m altitude). The MF radar provided studies of electron densities using the Differential Absorption Experiment [Gardner, F.F., and J.L. Pawsey, Study of the ionospheric D-region using partial reflections. *J. Atm. Terr. Phys.*, Vol. 3, No. 6, pp. 321–344, 1953]. The observations were made prior to, during, and after the geomagnetic storms.

The MF radar captured the D-region response during both the day and night, and across the dawn and dusk terminators. The D-region response to each storm is compared to the data collected under quiet conditions during a month prior to and a month after the geomagnetic storm.

The main features are as follows. First, during the storms, the intense scattered signals are observed over tenths to hundreds minutes below 72-km altitude. During these intervals, the protons precipitating from the magnetosphere are apparently the major ionizing radiation, and the proton fluxes derived from the MF radar data are of the order of 10^7–$10^8 m^{-2}s^{-1}$. Second, during the storms and in a few cases subsequently, the ionospheric D-region electron density exhibits sporadic or quasi-periodic oscillations with 40–50min periods and 100–150% or greater amplitudes. These disturbances in the electron density are probably due to charged particles precipitating from the radiation belt. Estimates provide fluxes of the order $10^8 m^{-2}s^{-1}$.

Terminators occurring during geomagnetic storms are shown to be capable of stimulating energetic electron precipitation from the magnetosphere. As it turns out, the electron fluxes induced by the terminators during the geomagnetic storms are equal to $(0.07 – 4.80) \times 10^9$ $m^{-2}s^{-1}$. These electron flux values are substantially in agreement with theoretical estimates and the well-known precipitating flux data acquired during disturbed conditions in the past.

ULTRA LOW FREQUENCY ELECTROMAGNETIC WAVES' LINEAR DYNAMICS AT INTERACTION WITH LOCAL INHOMOGENEOUS WINDS

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The generation and further dynamics of planetary ULF electromagnetic waves are investigated in the rotating dissipative ionosphere in the presence of a smooth inhomogeneous zonal wind (shear flow). Planetary ULF electromagnetic waves appear as a result of the interaction of the medium with the spatially inhomogeneous geomagnetic field. An effective linear mechanism responsible for the intensification and mutual transformation of these waves is found. For shear flows, the operators of the linear problem are not self-adjoint, and therefore the eigenfunctions of the problem maybe nonorthogonal and can hardly be studied by the canonical modal approach. Hence it becomes necessary to use the so-called nonmodal mathematical analysis which has been actively developed in recent years. The nonmodal approach shows that the transformation of wave disturbances in shear flows is due to the nonorthogonality of eigenfunctions of the problem in the conditions of linear dynamics. Thus there arises a new degree of freedom and a new way for the evolution of disturbances in the medium. Using numerical modeling, I illustrate the peculiar features of the interaction of waves with the background flow as well as the mutual transformation of wave disturbances in the ionosphere. It is established that the presence of a geomagnetic field, Hall and Pedersen currents in the ionospheric medium, improves the interaction and mutual energy exchange between waves and a shear flow.

Climate Studies

POSSIBLE SPACE WEATHER INFLUENCE ON THE EARTH WHEAT MARKETS

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We consider problem of a possible influence of unfavorable states of the space weather on agriculture market through chain of connections: "space weather"-"earth weather"-"agriculture crops"-"price reaction".

We show that new manifestations of "space weather"-"earth weather" relations discovered in the last time allow to revise wide field of expected solar-terrestrial connections. In the previous works we proposed possible mechanisms of wheat market reaction in the form of price bursts on the specific unfavorable states of space weather. We show that implementation of considered "price reaction scenarios" is possible only for condition of simultaneous realization of several necessary conditions: high sensitivity of local earth weather in selected region to space weather; state of "high risk agriculture" in selected agriculture zone; high sensitivity of agricultural market to possible deficit of supply. Results of previous works included application of this approach to wheat market in Medieval England and to modern USA durum market showed that real connection between wheat price bursts and space weather state is observed with high confidence level.

The aim of present work is answer on the question, why wheat markets in one region are sensitive to space weather factor, while another regional wheat markets demonstrate absolute indifferent reaction on this factor. For this aim we consider distribution of sensitivity of wheat markets in Europe to space weather as function of localization in different climatic zones. We analyze giant database of 95 European wheat markets from 14 countries during about 600-year period (1260-1912). We show that observed sensitivity of wheat market to space weather effects controlled, first of all, by type of predominant climate in different zones of agriculture. Wheat markets in the North and part of Central Europe (England, Iceland, Holland) shows reliable sensitivity to space weather in minimum states of solar activity with low solar wind, high cosmic ray flux and North Atlantic cloudiness, caused by CR excess, with negative sequences for wheat agriculture in this humid zone. In the same time wheat markets in the South Europe (Spain, Italy) show reliable sensitivity to space weather state in the opposite (maximum) phase of solar activity with strong solar wind, low cosmic ray flux and deficit of CR input in cloudiness in North Atlantic with next deficit of precipitations in the arid zones of the South Europe. In the same time the large part of markets in the Central Europe zone, functioned far from "high risk agriculture state" show the absence of any effects-responses on space weather. This asymmetry is in accordance with model expectation in the frame of proposed approach.

We discuss possible increasing of sensitivity of wheat markets to space weather effects in condition of drastic and fast change of modern climate, caused by global warming of the Earth atmosphere with fast and unexpected shift of numerous agriculture regions in the world to state of "high risk agriculture zone".

NEW FINDINGS INCREASING SOLAR TREND THAT CAN CHANGE EARTH CLIMATE

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A description of the most recent results on solar variability and its possible influence on the Earth`s climate and atmosphere will be addressed: historical records of solar activity indicate that solar radiation has been increasing since the late 19th century. However this trend is certainly modulated over long periods of time, and a cyclic periodicity can be found of about 120 years. Such an amplitude modulation would indicate a significant decrease in the forthcoming years. In a second part, we will focus on the energy transport from the Sun`s interior to Earth`s atmosphere, describing the role of the new shallow layer called leptocline and the so-called asphericity-parameter w.

Then we will explore the challenges induced by a reduction in modulation of the varying solar signals and how they affect long-term global climate change. Such a negative trend is also testify by other means, such as spectral observations of temperature sensitive lines indicating a decline of solar activity around 2015 (Livinsgston et al). Prediction of global effects from the Sun`s influence over the climate is thus impinged in a new way.

POSSIBLE TRACES OF SOLAR ACTIVITY EFFECT ON THE LAND SURFACE TEMPERATURE OF TURKEY

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In this study we investigate the effects of solar activity on the land surface temperature of Turkey. This enables us to understand existence of solar activity effects on the temperature. We used land surface temperature, pressure and tropospheric absorbing aerosol data as climate parameters and solar flare index data as solar activity indicator. We considered the parameters temperature, pressure and flare index data for the period data from January 1975 to the end of December 2006, which covers almost three solar cycles 21st, 22nd and 23rd. Only the tropospheric absorbing aerosol data includes from January 1980 to December 2005 period intervals. We found a remarkable correlation between solar activity and land surface temperature for only cycle 23. We applied Fourier transform to obtain the cyclic behavior of land surface temperature data sets. The most pronounced power peaks were found by this transform to be present at 2.2, 2.4, 3.9, 5.2, and 6.8 years which were reported earlier for some solar activity indicators. We concluded that signature of solar activity effect exists on land surface temperature of Turkey; besides changes of greenhouse gases and tropospheric absorbing aerosols concentration have also a dominant effect on the land surface temperature of Turkey.

IMPACT OF THE TOTAL SOLAR ECLIPSE ON 29.03.2006 ON SURFACE RADIATION

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We present results from a study of the spectral behavior of solar radiation reaching the Earth's surface during the course of the solar eclipse on March 29, 2006. Ground based spectral measurements were performed and digital images were obtained from a measurement site located on the Turkey's Mediterranean Sea coast near the town of Manavgat, Antalya region. The solar spectra were recorded using a high resolution multichannel spectrometer (Ocean Optics USB 2000) in the visible and near infrared ranges of the electromagnetic spectrum (350-900 nm). The spectral data were obtained from the reflected from standard screen solar radiation in 1010 spectral channels at a spectral resolution of 1.5 nm. The dynamics of the radiation coming from the visible part of the Sun during the 1st and 2nd and the 3rd and 4th contacts of the eclipse was analysed. Wavelength dependent changes in the registered solar spectra were established which were expressed by a slowly pronounced decrease in the radiation at the lower wavelengths. In studying the changes in solar radiation within the absorption bands of water vapours and of oxygen it was found that there are fluctuations of the spectral density. They are more significant just before the 2nd and after the 3d contact of the total solar eclipse. Changes were observed as well in the equivalent width of the absorption bands of water vapours and oxygen. Statistical methods such as the Student's t-criterion, variance analysis and discriminant analysis were applied in all cases of analysis.

SOLAR VARIABILITY AND CLIMATE DYNAMICS: A FRAMEWORK FOR ANALYSIS

Mackey, R

no institutional affiliation

The paper outlines a framework for the analysis of relationships between solar variability and climate in which the key solar variables are the independent and key climate variables are the dependent variables.

The independent variables are:

1. the Sun's output of:

(a) radiation, (b) matter;

2. the Sun's electromagnetic field;.
3. the Sun's gravitational field;
4. The Sun's shape;
5. The orientation of the Sun to the Earth

These solar variables, which are not entirely independent of each other, interact, amplifying total solar impact. The key dependent variables are:

1. The coupled atmospheric, oceanic systems;
2. The ocean systems;
3. The Rossby and Kelvin waves;
4. The Earth's rotation;
5. Atmospheric angular momentum;
6. The Earth's dynamo;
7. The Earth's electromagnetic field;
8. The global electric circuit

Like the solar variables, these variables are not entirely independent of each other. They interact with each other, sometimes amplifying total solar impact.

Effects of the independent variables can be anything from hours to hundreds of years after the solar event. For example, the climate impact of coronal mass ejections and solar proton events can happen within hours of the solar event. In contrast, the climate effect of the solar wind may be almost one hundred years after the solar event.

Other relevant factors include:

- The gravitational effects of the planets on the Sun, Earth, and Moon system.

Although tidal effects of the other planets on the Earth are very small, the planets can modify the shape of the orbits of the Earth and the Moon which has climate consequences.

- The interaction (if any) between the the planets and the the Sun around the center of mass of the solar system.
- Ever present in the background is the gradual, subtle, and complex change in the structure of the Earth/Sun geometry, giving rise to the Milankovitch processes.
- The natural internal variability in the climate system, including nonlinear processes, randomness and sensitivity to perturbations.
- Phase synchronisation between solar electromagnetic and gravitational oscillations (i.e. between the solar activity cycles and the lunisolar tides) and the Rossby and Kelvin waves.
- Resonant amplification between solar activity and climate cycles and between cyclical sub-systems within the climate system.
- The Earth's reflectance (albedo) and incidence of cosmic rays both modulate total solar impact.

If the global climate system, the dependent variables, is a heat engine, then all forms of solar activity together with these other relevant factors (the independent variables) are the sources of its energy.

The paper outlines the main relationships between independent and dependent variables.

The paper shows that the climate change effect of each of the electromagnetic field and the solar wind is greater than that of radiation; and that the climate change effect of short wave radiation is greater than that of long wave radiation.

As the time series of the phenomena are non-linear and non-stationary, it is necessary to use time series analysis methodologies that make the least possible assumptions about the data.

DETERMINATION OF AEROSOL OPTICAL CHARACTERISTICS IN THE TROPOSPHERE BY SUN PHOTOMETER AND LIDAR

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In the present investigation one year measurements of the atmospheric aerosol optical characteristics (extinction coefficient, aerosol optical depth (AOD) and Ångström coefficients) during the development of the convective boundary layer (CBL) over Sofia (Bulgaria) are presented.

The lidar equation in case of single scattering was used to process the lidar data. The mixing layer height (MLH) could be determined according to the first and second derivative method and standard deviation method. The theoretical data concerning the CBL development are obtained following the Whiteman and McKee model. The AOD given by the sun photometer is being calculated according to Beer-Lambert-Bouguer law. The Ångström coefficients are calculated using the Volz method.

A lidar (developed in the Laser Radar Laboratory at the Institute of Electronics) and a commercial five-channel Microtops II sun photometer were used to carry out the present study.

The lidar data are presented as height-time indicators (HTIs) of the S-function of the lidar signal. The MLH changes during the different seasons from H_{ML}=400 m to H_{ML}=1800 m in winter and in summer, respectively. The formation of the mixing layer passes through different stages and has different speeds of development. The special feature of the aerosol structure of the atmosphere in 2007 is the presence of the aerosol layers due to advection from powerful local sources. Similar layers are observed in the past years when the industry in Sofia was highly developed. The MLH obtained from the lidar data are compared to the MLH obtained following the Whiteman and McKee model.

The sun photometer data shows a few different kinds of behaviour of the AOD during the formation of the CBL. The AOD behavior could be summarized in three types as follows: in the first one AOD fluctuates around a constant value during the PBL formation; in the second one AOD has maximum value during the PBL formation and in the third one – AOD gradually increases during the PBL formation. The Ångström coefficients show the turbidity of the atmosphere and the size distribution of the particles within the whole column from the ground surface to the Sun during the different seasons. The AOD has maximum value in summer (t_a=0.41) and minimum value in winter (t_a=0.21).

The lidar data clearly show the heights and the time when elevated temperature inversions (detaining the aerosol layers) are destroyed and the formation of the mixing layer. The sun photometer data show the variation of the aerosol optical depth during the development of the mixing layer.

Joint interpretation of the data from the two devices shows the influence of the meteoparameters and the orography of the region on the atmospheric aerosol optical characteristics and on the ecological situation over the city.

THE INFLUENCE OF GEOMAGNETIC ACTIVITY ON THERMOBARIC CHARACTERISTICS OF TROPOSPHERE.

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The main points of the model of the solar activity effect on the Earth climatic system are presented. The key concept of the model is heliogeophysical disturbance effect on the Earth climatic system parameters, which control energy flux, going from the Earth to the space, in high-latitude areas. The model is based on the physical mechanism of heliogeophysical factors' influence on climatic characteristics and atmospheric circulation in the high-latitude troposphere through the atmospheric electricity. In accordance with

this mechanism, the atmospheric electricity parameters in the high latitudes depend on the solar activity; at the same time, they influence the altitude distribution of charged condensation nuclei in the troposphere, as well as the cloudiness formation and radiation balance. The mechanism is proved to operate more efficiently in the high latitudes resulting in additional cloudiness formation in areas with adequate vapour concentration.

We present complex analysis results of response of temperature and tropospheric pressure fields to different heliogeophysical disturbances.

It is shown that the largest and unambiguous influence of solar activity on the climate system condition is observed during the periods when there is absence of the ingoing radiation flux of the energy (high-latitude regions during the cold period), because in this case any cloudiness leads to the decrease of energy losses by the climate system.

Particularities and regularities are considered of long-term variation in temperature regime of the troposphere and ocean in 1950-2007. It is showed that a continuous increase of the Earth climatic system heat content has been observed from 1910 till now. The so-called "cooling" of 1945-1975 presents inherent natural fluctuations in the Earth climatic system. The "cooling" can be explained by changes of circulation in the atmosphere and ocean as well as heat exchange between the atmosphere and ocean.

Under the model, we made analysis of regularities, which underlie variations of geomagnetic activity and troposphere thermobaric characteristics. These results and changes of the global circulation in the atmosphere and ocean allow the conclusion that the warming observed in the 20th century can be mostly explained by variations of the solar activity level. The surface temperature anomalies in 1940-1975 and 1976-1979 and the World Ocean heat content changes result from a response peculiarity of thermal and dynamic regimes of the World Ocean and atmosphere to changes of processes in the atmosphere, ocean and cryosphere. These changes are associated with the warming in polar areas in the early 20^{th} century. The main determining factors of the process are changes in the Arctic Ocean's frost mass and north rivers' outflows, which regulate the North Atlantic salinity, thermohaline circulation characteristics and atmosphere-ocean energy exchange.

Necessity was shown to consider changes in the atmosphere and ocean circulation (including El Nico – La Nica), cryosphere, thermohaline circulation and volcanic effects to determine quantitative contribution of the solar activity and anthropogenic factors to fluctuations of the global surface temperature, heat content of the atmosphere and ocean.

MECHANISMS OF SOLAR INFLUENCES ON THE POLAR ATMOSPHERE

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The enhanced variability of the weather and climate is one of the main consequences of the global warming. That's why the understanding of mechanisms leading to establishment of colder than usual winters in the middle and northern Europe and warmer and wet periods in the Mediterranean countries is especially important for improvement of seasonal and intraseasonal forecast.

Previous analysis of the problem found out a relation with the sign of Arctic Oscillation index (based on the difference between sea level pressure between Azores and Island). The solar and QBO (quasi biennial oscillations of the equatorial stratospheric winds) signals in the polar atmosphere are also well documented. One of the most exploited hypothesis suggest that teleconnections between equatorial and polar atmospheres is modulated by the solar variability through changes of the wave propagation conditions in the middle atmosphere - an important link in stratosphere-troposphere connections. Our preliminary studies show that the wave forcing only in not enough for winter time weakening and breaking of polar vortex. We hypothesise that at least part of the events of polar vortex break down may be attributed to an external factors like comprehensive solar-QBO influence on the mean troposphere-stratospheric circulation or cosmic ray showers in the auroral oval (approximately around 600N).

In the context of the above problem, a statistical analysis of ERA-40 data sets for temperature, winds, ozone, eddy momentum and eddy heat fluxes have been performed

in order to reveal some relations between factors determining internal and external forcing of the atmospheric system. Data was separated on composites regarding the sign of AO index, solar activity and QBO phase in attempt to answer the question: "What are the reasons for polar vortex weakening - which serves as a barrier for intrusion of Arctic air masses in mid-latitudes - and correspondingly colder winters in Europe, appearing more frequently in periods of high solar activity and west QBO phase or low solar activity and east QBO phase?

Our initial results show that while during east QBO phase the solar variability and particle precipitations effect mainly upper stratospheric circulation, for west QBO phase - solar variability and the intensity of particle precipitation have a significant impact in vortex erosion. More precisely, up to 50% of zonal wind total variability may be attributed to external forcing (i.e. solar radiation and cosmic rays intensity). Besides direct effect on polar atmospheric temperature and dynamics, the cosmic rays may have additional influence trough the modification of ozone profile. This possible effect is under consideration now

PHYSICAL MODEL OF SOLAR ACTIVITY INFLUENCE ON CLIMATE CHARACTERISTICS OF TROPOSPHERE

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The new model of solar activity influence on parameters of the terrestrial climate system is discussed. The main points of the model of solar activity effect on the terrestrial climate system are presented. The key conception of this model is influence of heliogeophysical disturbances on the terrestrial climate system parameters controlling the energy flux going from the Earth to the space in Polar Regions. The model is based on physical mechanism of heliogeophysical factors influence on climate characteristics and atmosphere circulation in high-latitude troposphere through atmosphere electricity. According to this model, the growth of solar activity result in decrease of radiative cooling in high-latitude regions, increase of temperature of lower and middle troposphere, reorganization of thermobaric field, decrease of mean meridional gradient of temperature between polar and equatorial regions, which determine the meridional transportation of heat. Decrease of heat flow-out from low-latitude regions result in temperature increase of lower and middle latitude regions, and increase of heat content of the ocean and climate system. There are presented something of observational data that confirm the proposed model.

The authors acknowledge the Russian Foundation for Basic Research (Grant No. 06-05-81011-Bel_a), Programme of Basic Research of Presidium of RAS, No 16, and Programme ESD RAS No. 7.11.2 for financial support.

ESTIMATION OF THE SOLAR ACTIVITY CONTRIBUTION IN HEAT CONTENTS OF ATMOSPHERE

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There are represented results of research of solar signals in the troposphere with use of meteorological data from which is excluded the influence of El Niño, stratospheric aerosols and the Arctic ice area. Average monthly values have been corrected for El Niño, volcanic effects stratospheric aerosols and the Arctic ice area using a multi-variate regression procedure. During this research solar influence is certain by quantitatively geomagnetic index AA and solar radiostream F 10.7. The best response is found at use of index F 10.7. In meteorological parameters it is well traced 11-years and 22-years cycles of solar activity. The coefficient of correlation between parameters of an atmosphere and index F 10.7 for numbers of the data smoothed on 5 years reach 0, 68. We show, that significant solar signals are found out in all major observables throughout the low-latitude and middle-latitude troposphere and that there is spatially non-uniform model of the response, the important role in which is played by water steam and large-scale systems of tropospheric circulation. The obtained data allow to clear a question on, where and how the sun influences climatic system.

FAIR-WEATHER ELECTRIC CURRENTS AND FIELDS IN TROPOSPHERE AND STRATO/MESOSPHERE AND THEIR VARIATIONS BY SOLAR ACTIVITY CHANGES – A MODEL ESTIMATION

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The global atmospheric electric circuit (GEC) has been considered in many works as a climate formation factor, which is realized through the ionosphere-ground fair-weather electric current of about 2 pA per square meter and their related electric fields. These currents and fields presumably play an important role in the microphysical processes in the clouds on Earth. Due to that, considerable changes in weather and climate characteristics can take place by variations of these currents and fields, provoked through solar activity changes. The solar wind can affect the ionosphere-ground fair-weather electric current by different ways: by modulation of the galactic ray flux, which is responsible for the conductivity in the lower stratosphere and upper troposphere; by changes in the precipitation of relativistic electrons; and by variations of the ionospheric potential in the polar caps. In our work the fair-weather electric fields and currents and their variations due to solar wind changes are studied theoretically in different atmospheric regions (troposphere, stratosphere and mesosphere), where these fields and currents presumably affect different microphysical processes. For this goal we propose a global-scale model of the electric fields and currents generated by thunderstorms and electrified shower clouds. This model is based on the Maxwell's equations under quasi-static conditions. We evaluate by the model the variations of the fair-weather electric current due to changes of the conductivity profiles at different latitudes and of the ionospheric potential caused by the solar wind variations. The conditions are studied where and when maximal variations of ionosphere-ground current are realized, and its lower and upper values are estimated. We also evaluate the fair-weather electric fields created in the strato/mesosphere by the global thunderstorm activity; they are discussed as possibly affecting the physical processes at these altitudes, as well. The variations of these electric fields with the solar activity changes are studied.

PROSPECTS FOR CURBING ENVIRONMENTAL DEGRADATION THROUGH AN EXTENSIVE GENERATION AND USE OF ALTERNATIVE SOURCES OF ENERGY – THE CASE OF MZIMBA AND RUMPHI DISTRICTS, MALAWI

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Issues of environmental degradation have received unprecedented coverage in Malawi. Documentation in this respect ranges from Acts of Parliament some of which are based on international conventions such as the SADC protocols, giuidelines for mounting environmental impact assessments (EIA) and open ended / timeless recommendations / workshop resolutions on the restoration of the severely degraded environment. Come to think of it, issues of the physical environment have been enshrined in the Constitution of Malawi (Phiri, 2008). To crown it all, the local print and electronic media ia awash with feature stories, case studies depicting the state of the environment and sporadic attempts at curbing environmental degradation. The broad information base is a reflection of an equally wide variety of experts on the environment. As one weighs the information base against existing expertise on the environment, one is greeted by an overriding vital statistic, namely, a heavy overdependence on natural resources which reduces the Malawi economy to as essentially extractive enterprise. To this effect, as high as 75% of Malawi's population is employed in agriculture, i.e. wage earners and full time farmers. If this statistic is expressed in economic terms, agriculture contributes a high 30% to the country's GDP. A further breakdown shows the 30% translates into 90% of current exports of Malawi of which 70% is tobacco. Of the full time farmers, 70% are women (Green and Baden, 1994). Closely related to the above statistics, is Malawi's overdependence on forests which meet 90% of the country's energy requirements.

To a certain extent, the extractive nature of Malawi's economy is the nucleus of the never ending vicious poverty cycle which Chambers (1983) has called integrated or pervasive poverty. On the contrary, if a nation uses the same abject poverty as a springboard for taking appropriate action, it turns the situation around. (Simbi, Phiri,

2005). Expressed otherwise, appropriate action is a natural product of three closely related mental processes. The first one is the development of an appropriate perception. The second one is the ability to formulate a vision. The last one is the ability to gather courage and charisma (Hall, Jones and Raff, 1997).

An analysis of the situation on the ground shows that Malawi is making great strides towards curbing environmental degradation through the generation and extensive use of energy from sources other than firewood, charcoal and fossil fuels.

USING WEATHER COMBINATION METHOD IN CLASSIFICATION BIOCLIMATIC CONDITIONS OF VIETNAM FOR TOURISM, CONVALESCENCE AND SOME WEATHER THERSPIES

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Solar energy is very superabundant inside tropic latitudes. However, in Vietnam this plentiful energy was redistributed significantly by winter monsoonal circulation. Our study is one attempt to show this difference.

Utilizing synthetic quantitative method this paper presents result of classification and assessment of bioclimatic conditions for human health in general (for convalescence in highland and for tourism at a whole). In this method, by using weather combination of 4 meteorological elements (temperature, humidity, wind speed at 13 pm. and the existence of fog/rainfall in the daylight), the every day weather are classified. Results of classification of 1,826 weather combinations/station, collecting from 20 stations in Vietnam are follows:

1. In the territory of Vietnam, the number of good weather days vacillates in big distance, from 308.4 day/year in Vung Tau to 109.6 days/year in Sa Pa.

* For the tourism: In the South and Northwest regions, there are many good weather days. Vung Tau, Con Dao Island, Nha Trang have about 300 days/year. Phan Thiet, Ha Noi, Dian Bien, Hue, Rach Gia : 250 - 280 days. In the rest places like Co To Island, Ho Chi minh City... there are about 200 days/year.

*For convalescence: In mountainous regions Sa Pa has 109 days/year; Tam Dao - 129 days; Da Lat - 183.7 days/year.

2. In Different regions of Vietnam, the good weather period is not similar.

*For tourism: In Northeast Region: the good weather period is shortest, it lasts from April to November (Co To Island). In Bac Bo Region: the good weather period is longer, it is interrupted in February (Ha Noi, Sam Son). In North West Region: good weather period is around year (Dien Bien). In Central Region, it is not only longer but also distributed evenly durng a year (Nha Trang). In Nam Bo Region the period for tourism is around year (Vung Tau, Con Dao island)

*For convalescence: In Mountains of North Region (Sa Pa, Tam dao, Moc Chau) the good weather period is shorter than in the South, it concentrated mainly in summer time. In Central Plateau Tay Nguyen (Da lat) the good weather period for convalescence is around year. In difference with the North, the good weather period here distributes rather evenlly in the whole year. Totally, Da Lat is best place for human health, medical weather therapeutic treatment and convalescence in highland of Vietnam.

COSMIC RAY SHOWERS AND THEIR RELATION TO THE STRATOSPHERIC SUDDEN WARMINGS

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The role of planetary waves forcing for generation of stratospheric sudden warming (SSW) is broadly exploited recently. However, difficulties for the stratospheric resolving GCMs to reproduce the observed climatological polar vortex [Charlton et. all, 2007] is an indication that some other factors may serve as a trigger mechanisms for SSW. Taking into account that the corpuscular particles showers are most intensive into the auroral oval (approximately 600N) it is quite naturally to suggest that the effect of their heating may affect the thermo-dynamical regime of the polar atmosphere.

To test this hypothesis a detail statistical analysis of temperature, zonal wind and O3 profiles from ERA-40 reanalysis combined with satellite and ground-based measurements of the cosmic rays penetrating the atmosphere is arranged. Three from all five northern hemisphere winters - with two major stratospheric warmings observed - are analyzed, namely 1987-1988, 1998-1999 and 2001-2002.

Although great variability in manifestation of each SSW event, some regular behavior have been found from our preliminary analysis. It will be shown that the temperature anomalies of the polar region are: i.) slightly affected by the wave activity, which impact is small and non significant for all SSW events; ii.) the most effective are zonal wind profile at 600N and local O3 profiles, describing 80-90% of total temperature variability; iii.) impact of solar and quasi biennial oscillation (QBO) of the equatorial stratospheric winds rise up to 50% in the polar cap upper troposphere and lower stratosphere; iv.) direct effect of precipitating particles on the temperature variability is about 40%, but their possible influence on the ozone and wind profiles is under consideration.

Results will be discussed in the light of the mechanisms leading to formation of different types of SSW, i.e. vortex displacement and vortex split.

THE RELATIONSHIP BETWEEN SOLAR ACTIVITY AND SOIL WATER BALANCE

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In this paper we present the relationship between the soil water deficit and the solar activity as a possible factor that influence the Earth`s climate. By use of spectral analysis (Fast Fourier Transform) a periodicity of 10.6 years was found in the data series of soil water deficit based on the Thornthwaite method of calculating evapotranspiration, which is similar to the periodicity of 10.6 years found in the series of Wolf-s relative number of sunspots. According to these results we can implicitly confirm that anomalies in the series soil water regime i.e. the occurrence of dry spells (1991-1993, 2000-2003), are closely related to an increase in solar activity.

SMALL-PARAMETRIC NONLINEAR MODEL TO STUDY THE FEATURES OF REGIONAL LARGE-SCALE CYCLOGENESIS

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It is suggested the small-parametric nonlinear model to describe the features of large-scale regional cyclogenesis including its seasonal behaviour. The model allows to investigate, in particular, the influence of solar-terrestrial relations on the tropical cyclogenesis as the sequence of typhoon events. Our model includes a number of free parameters and their choice gives the possibility to control the temporal dynamics of process studied. So the model developed gives the example of analytical description for large-scale regional cyclogenesis as the sequence of cyclones and the full life cycle of each vortice is taken into account.

SOLAR SIGNATURE IN THE DROUGHT OCCURRENCE IN KENYA, EAST AFRICA

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Drought is a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. Drought is an insidious hazard of nature. The periodicities associated with drought occurrence in Kenya, East Africa have been examined using a set of data obtained courtesy of the Kenya Meteorology Department (KMD). The KMD meteorological network consists of more than thirty nationwide distributed meteorological observatories. Drought indices were estimated from the rainfall data obtained from five of such observatories and subjected to Fast Fourier Transforms in order to obtain the periodicities associated with the indices at various locations. The spectral analysis revealed the periods associated with solar activities. The observed periodicities are explained in terms of associated solar terrestrial processes. Solar control is evidenced in climate change/variability.

Heliobiology

COSMIC RADIATION DOSIMETRY IN INTERNATIONAL FLIGHTS OF ARGENTINE AIRLINES

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INTRODUCTION. In Commercial Aviation it is well known that the most important determinants of radiation exposure in humans are the altitude, latitude, flight duration, and the date of exposure in terms of the solar cycle. A study was conducted to address this type of exposure by way of physical dosimetry.

METHOD. The study was performed in the business-class cabin of an Airbus 340-200 aircraft, provided by Argentine Airlines, during 2 flight routes: New York – Miami – Buenos Aires (transequatorial) and Buenos Aires – Auckland (circumpolar). Measurements addressed the electromagnetic spectrum or low Linear Energy Transfer (LET) and corpuscular radiation (High LET). The instruments used were an Ion Chamber (IC), to measure the ionizing component of radiation (i.e., gamma radiation), the SWENDI, to measure only the neutron component, and the Tissue Equivalent Proportional Counter (TEPC) for measuring all radiation types.

RESULTS. The routes' dose rates are presented in the table. TEPC rates agreed with the LET findings. The total dose rates of high latitude flights were higher than those of low latitude flights. The SWENDI (High LET) results for the flights over the equator, at low latitude, represented only 1/3 of the total radiation. The New York - Miami and Buenos Aires -Auckland flights, at high latitude, represented just under 1/2 of the Total radiation (-45%).

CONCLUSION. Based on the results of this study, the annual dose rates of radiation exposure of aircrew personnel serving on international flights offered by Argentine Airlines is between 3 and 7 mSv. This rate is higher than the maximum recommended for the general population by the International Commission on Radiological Protection (ICRP), which is 1 milliSv./y. Therefore, these personnel must be officially considered "Occupationally Exposed to Radiation" in way to provide the appropriate measures that must be implemented for their protection in accordance to ICRP guidelines.

DIRECT AND INDIRECT INDICATORS OF SPACE WEATHER INFLUENCE ON HUMAN PHYSIOLOGICAL AND CARDIO-VASCULAR HEALTH STATE IN MIDDLE LATITUDES: RESULTS OF AZERBAIJANI/COLLABORATIVE STUDIES

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The possibility that solar activity variations and related changes in the Earth's magnetosphere can affect human life and health has been debated for many decades. This problem is being studied extensively in the late 20th and early 21st centuries and it is still being contradictory. The relations between space weather changes and the human health have global implications, but they are especially important for habitants living at high geomagnetic latitudes where the geomagnetic disturbances have larger amplitudes. Nevertheless, the relevant researches are also important for humans living at any geomagnetic latitudes with different levels of geomagnetic activity; studies show that not only extremely high, but low levels of geomagnetic activity also may have significant influence on ecosystems. Unfortunately, limited comparison of results of investigations on possible effects to humans from geomagnetic activity exists between studies conducted in high, middle and low latitudes. Knowledge about the relationship between solar and geomagnetic activity and the human health would allow to get better prepared beforehand for any future geomagnetic event and its impacts anywhere.

For these purposes there are conducted collaborative (jointly with scientists from Israel, Bulgaria, Russia and Belgium) and cross-disciplinary space weather studies in the Azerbaijan National Academy of Sciences for revealing possible effects of solar,

geomagnetic and cosmic ray variability on certain technological, biological and ecological systems. This paper reviews some recently obtained results of the complex (theoretical, experimental and statistical) heliobiological studies of influence of the periodical and aperiodical changes of solar, geomagnetic and cosmic ray activities upon human cardio-health state as well as human physiological and psycho-emotional state. It also covers the results of studies on influence of violent solar events and severe geomagnetic storms of the solar cycle 23 on the mentioned systems in middle-latitude location. Effects of weak geomagnetic disturbances are studied.

In these studies, direct and indirect indicators of space weather influence are used. Alongside statistical investigations on the medical-biological statistical data, there are conducted daily medical-physiological experiments (acupunctural studies of conductivity of the biologically active points of human body, heart rate measurements, so on in days with different geomagnetic activity levels) in the Laboratory of Heliobiology, Baku, Azerbaijan, as a part of collaborative studies.

GEOMAGNETIC STORMS AND ACUTE MYOCARDIAL INFARCTIONS MORBIDITY IN MIDDLE LATITUDES

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Results of collaborative studies on the revealing a possible relationship between solar activity (SA) and geomagnetic activity (GMA) and acute myocardial infarct (AMI) morbidity are presented. Studies were based on medical data from Bulgaria and Azerbaijan. Bulgarian data, covering period from 1.12.1995 to 31.12.2004, concerned daily distribution of patients with AMI diagnose (in total 1192 cases) from Sofia region on the day of admission at the hospital. Azerbaijani data contained 4479 pre-hospital AMI cases for the period 01.01.2003-31.12.2005, collected from 21 emergency first medical and emergency aid stations in grand Baku area (including Absheron Economical Region with several millions of inhabitants).

Data were "cleaned" as much as possible from social and other factors. Later on they were subjected to medical and mathematical/statistical analysis. Medical analysis showed reliability of used data. ANOVA was applied to check the significance of GMA intensity effect and the type of geomagnetic storms - those caused by Magnetic Clouds (MC) and by High Speed Solar Wind Streams (HSSWS) - on AMI occurrence. Relevant correlation coefficients were calculated. Results were outlined for both considered data.

Results obtained for the Sofia data (1995–2004) showed statistically significant positive correlation between considered GMA indices and AMI occurrence. Analysis of variance (ANOVA) revealed that AMI number was significantly increased from the day before till the day after geomagnetic storms with different intensities. Geomagnetic storms caused by MC were related to significant increase of AMI number in comparison with the storms caused by HSSWS. There was a trend for such different effects even on -1st and +1st day for the period 1995-2004.

Results obtained for the Baku data (2003-2005) revealed trends similar to those obtained for Sofia data (1995-2004). AMI occurrence increment was observed on the days with higher GMA intensity and after these days as well as on the days of geomagnetic storms caused by MC and after these days.

SEASON VARIATIONS OF MAGNETIC STORM INFLUENCE ON MYOCARDIAL INFARCTIONS

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Our previous analysis of the myocardial infarction (MI) in Moscow and Bulgaria demonstrated strong season variation with the profound summer minima and winter maxima. However, it is well known that the maximum of magnetic storm occurrence is attributes to equinox, not to winter. Thus, we suggest that a biotropic efficacy of the magnetic storms may depend on the season. We analyzed 129 geomagnetic storms with

Dst from −50 nT to −250 nT in 1979-1981 (near solar activity maximum) and found that 75 storms were observed in spring/autumn, 32 – in summer, and 22 – in winter. About of 80% of the spring/autumn and about of 90% of the winter magnetic storms were accompanied by MI enhancement, but only less then 5% of the summer magnetic storms showed the MI enhancement. We also found that as usual, the storm main phase was not accompanied by MI enhancement, except the events when the storm main phase was developed on the recovery phase of the previous storm. But the storm recovery phase typically leads to MI increasing. The role of different types of storm-time geomagnetic pulsations has discussed. We suggest that a seasonal variation of the production of the pineal hormone melatonin leads to a stronger summer stability in the human organisms to the "negative" influence of magnetic storms and geomagnetic pulsations. We conclude that the heliobiological study has to take into account the different seasonal effects in a state of sick human organisms.

MAGNETOSENSITIVITY DETERMINATION BASED ON DIRECT DEPENDENCE RECOVERY

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Arterial blood pressure (ABP) of healthy volunteers was measured in working days during a period of comparatively high solar and geomagnetic activity (altogether 2799 measurements in autumn 2001 and spring 2002) in Sofia. Data for some subjective psycho-physiological complaints were also collected. It has been obtained in our previous studies that reaction of some physiological parameters to geomagnetic disturbances may have a delay up to 4 days long. Thus we supposed dependence of Systolic and Diastolic Blood Pressure (SBP and DBP) on Ap-index to be essentially characterized by 6-dimensional hypersurface because ABP in t_i depends on Ap in $t_i, t_{i-1}, t_{i-2}, t_{i-3}, t_{i-4}$. It has been accepted that a person was magneto-sensitive if the influence of Ap was so strong that the most significant peaks of SBP/DBP could be predicted from only values of Ap from appropriate delay sequence. Method of prediction is based on Direct Dependence Recovery (DDR). For that purpose Ap and SBP/DBP were divided into two parts. The first, so-called Learning Part (L), and second Examining Part (E). DDR module was suggested to obtain hypersurface of dependence SBP/DBP in t_i on Ap in previous moments $t_i, t_{i-1}, t_{i-2}, t_{i-3}, t_{i-4}$ and than extrapolate this dependence on E-part as a result of forecasting. We concluded that given persons were magneto-sensitive if there were obvious coincidences between predicted and real peaks of SBP/DBP, especially in days with subjective persons' complaints.

We were able to make any conclusions only about persons who had sufficient statistics N accordingly to stochastic radius R of delays' pool. Indeed, R is approximately given by formula $R \approx A \sqrt[Q]{\frac{1}{N}}$, where A is the range of varying of Ap-index, Q is the dimension of delay sequence (in our case $Q = 5$). It is clear that for sake of proper DDR process R could not exceed a half of entire range A, so here we are: $A \sqrt[Q]{\frac{1}{N}} < \frac{1}{2} A \Rightarrow N > 2^Q$ and in our case $N > 2^5 = 32$. That condition was satisfied for 37 persons from the group examined. 13 persons from them (about 32%) turned out to be magneto-sensitive. Other people also demonstrated obvious coincidence of Ap-based predicted and real SBP/DBP in days with complaints only.

HELIOGEOMAGNETIC RHYTHMS ARE INDEED SYNCHRONIZERS OF BIOLOGICAL "CLOCKS" AND RESYNCHRONIZATION OF THESE CLOCKS BY GEOMAGNETIC AND METEO-FACTOR DISTURBANCES ARE RESPONSIBLE FOR HEAL

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One of important period of study of biological effects of space weather started from invented hypothesis about role of weak natural electromagnetic fields as harbingers - biological clocks, created endogenous time structure of biological systems, including humans by analogy with circadian time structure, created by solar light and temperature `accordingly. There were many indirect arguments well fitted with this concept like for example similarity of several important periods in solar and geomagnetic variations and in biological systems at all levels from cells to organs, organisms and even population. Some data showed similarity in time dependent spectral variations and were used as a special argument for confirmation of general idea. However only recently we have got some very plausible and exclusive confirmation that in current life of adult healthy humans there is the synchronization of some medical parameters like arterial blood pressure and heart rate, with rhythms of geomagnetic activity. For cases of resynchronization of external harbingers human cardiovascular system in pathology reacts with some delay about one or two days, i.e. has a maximal reply during recovery phase of geomagnetic storms. For people suffering from hypertension such resynchronization can be connected with meteoroligal factors

HELIO-GEOPHYSICAL IMPACT ON VARIATIONS OF BASIC ECG PROPERTIES IN LIGHT OF NONLINEAR DYNAMICAL MODEL

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This study was conducted to explore the impact of the global helio-geophysical factors on the organism of a healthy person and with further aim to quest for the mechanisms of a chronical seasonal exasperations, especially those related with cardio-vascular problems. We discuss the results of the numerical simulations of stability of the basic properties of human electrocardiogram (ECG) under weak external action. The system of the ordinary differential equations is used. It was obtained by Anishenko et all (JCTE, 1997) with help of the global reconstruction algorithms. Preliminary results show the weak influence of the small but finite variation of external force (with relative amplitude about 10%) on the properties of RR wave. While the PQ and ST part of the cardiac complex may change, especially, in respect of their symmetry properties. The given behavior is illustrated, as well, with help of the simplified nonlinear dynamical model where the cardio-wave is considered as a sum of two: basic wave (associated with RR) and one weaker component with higher frequency. The developed model is used for interpretation the recent result of distributed helio-medical monitoring «Heliomed» that is conducted simultaneously in Moscow, Yakutsk, Kiev and Simferopol. Our results suggest the feasibility of the methods based on the nonlinear dynamical system approach to quest for the ECG properties which are sensitive to a weak external action

IS THE NUMBER OF INFLUENZA PATIENTS RELATED TO CHANGES IN THE ENVIRONMENTAL PHYSICAL ACTIVITY?

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Appearance and spread of epidemics and/or pandemics of infectious diseases depend mainly on genealogical, physiological, summary of social and additional factors, but precise timing of their appearance could also be affected by environmental physical factors. Influenza (or as it is commonly known, the flu or the grippe) takes a special place among epidemic diseases. The success of the strife with influenza depend on the well-timed forecast about the most probable time of influenza epidemics with purposes to have enough time for conducting of relevant preventive measures. This forecast will be incomplete without considering the possible impact of environmental physical (heliogeophysical and cosmic ray) activity on influenza fluctuations. The timing of epidemics, differences in the immune system and, probably, mutations of pathogens can be affected by changes in space weather conditions.

The aim of this study was to check the dynamics of number of influenza patients in a big urban area in relation to solar (SA), geomagnetic (GMA) and cosmic ray (CRA) activity. Data covered 300 months (1976-2000) and n = 50581 patients in the Grand Baku Area and corresponded to the different phases of two solar activity cycles. Statistical and correlation analyses were performed. Pearson correlation coefficients and their probabilities were obtained. A multivariate analysis model was build for prediction possibility.

Association between solar and geomagnetic activity and influenza outbreaks is discussed. On the basis of the analysis of the most significant influenza occurrence (epidemics and pandemics) in 20th century, compared with periodic changes in the cycles of SA, regularities in the manifestation of the biorhythms of the epidemic activity of influenza-A virus have been discussed. Seasonal variations are also studied. H1N1 strain of influenza virus shows periodicity of appearance approximately every 30-35 years, which is close to the so called ~ 35-year Bruckner (climatic) cycle. Results are outlined and discussed.

Results: The number of influenza patient was inversely related to month of the year (1-12) ($p<0.0001$), and CRA ($p=0.02$) and correlated with SA ($p = 0.01$). Some physical parameters that were available for part of the observation period and related to solar and geomagnetic activity, like radio-wave propagation conditions and hours of the ionosphere ionization also show significant relationship with monthly influenza number.

POSSIBLE EFFECTS OF SOLAR AND GEOMAGNETIC ACTIVITY ON SUDDEN CARDIAC DEATH

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In this paper results revealing potential effects of solar and geomagnetic activity (GMA) on the dynamics of sudden cardiac death (SCD) in middle latitudes are described. Medical data were taken from all of Emergency and First Medical Aid Stations of Grand Baku Area with millions of inhabitants for the time period 2003-2005. In total 788 SCD cases were analyzed.

Analysis of variance (ANOVA) was applied to study the significance of GMA influence, estimated by different geomagnetic indices, and the type of geomagnetic storms (caused by the solar origin magnetic clouds (MC) and by high-speed solar wind streams (HSSWS)) on SCD. Correlation analysis was carried out and relevant coefficients were calculated.

Obtained results revealed strong negative correlation between monthly averaged GMA and SCD in Baku for the considered period. ANOVA revealed that SCD number was largest on the days of low GMA, on the days of highest geomagnetic field variations and on +2nd day after them. It was established that SCDs increased on the days of storms caused by HSSWS and remained higher till +2nd day after them.

SLEEP IN MICROGRAVITY - CHANGES IN THE STRUCTURE AND EFFICIENCY

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A limited number of physiological studies of sleep in space flights are done up to now. A series of registrations of sleep during space flight of different prolongation have been carried out on board the manned Mir orbiting station. The aim of this paper is to compare the data from longitudinal study of structure, efficiency and psyho-physiological characteristics of cosmonauts sleep during pre-starts period, space flights and post-flight period. The role of sleep for the regulation and adaptation processes in microgravity is emphasized.

COSMIC RAYS VARIATIONS AND HUMAN PHYSIOLOGICAL STATE

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It was obtained in our previous investigations that geomagnetic activity as an indirect indicator of solar activity correlates with some human physiological and psycho-physiological parameters. A lot of studies indicate that other parameters of space weather like cosmic ray Forbush decreases affect myocardial infarction, brain stroke, car accidents. The purpose of that work was to study the effect of cosmic rays variations on human physiological status. It was established that decrease in cosmic rays was related to increase in systolic and diastolic blood pressure and reported subjective psycho-physiological complaints in healthy volunteers.

INFLUENCE OF SOLAR AND GEOMAGNETIC ACTIVITY ON THE INCIDENCE OF INFECTIOUS DISEASES IN BULGARIA

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It is well known that the incidence of some infectious diseases shows certain cyclicity. In some cases (tick-borne infections, food-borne diseases, etc.) which have definite seasonality this may be related to similar cyclicity in temperature and precipitation, while for other diseases the dependence on climatic variations is not proved. We compare time series of the incidence of several infectious diseases in Bulgaria with long data records to the variations in solar and geomagnetic activity, precipitation and temperature to estimate whether solar activity has effect on the incidence of the studied diseases and if so, whether this influence is mediated by the influence of solar activity on temperature and precipitation, or there are other heliophysical factors directly affecting the infection.

Other Related Topics

THE ELECTRICAL ENVIRONMENT OF TITAN AFTER HUYGENS: LOWER IONOSPHERE AND ELECTROMAGNETIC RESONANCES

Hamelin, M., and the PWA-HASI team

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Three years after the descent of the HUYGENS Probe through the atmosphere of Titan and its successful landing, January 14th, 2005, we present a summary of the major scientific results in the field of atmospheric electricity. The Permittivity, Waves and Altimetry (PWA), a subsystem of the HUYGENS Atmospheric Structure Instrument (HASI) was designed to measure the conductivity of the atmosphere and of the ground at the landing site, and to detect electromagnetic waves in Titan's ionospheric cavity. These parameters, in addition to CASSINI measurements of the upper ionosphere, are those governing a global atmospheric electric circuit of Titan, and wave characteristics might give new insights on possible electrical wave generators as well as deep sounding of the subsurface. The HASI-PWA data have been archived in the ESA Planetary Science Archive.

The atmospheric conductivity driven by electrons, measured by two independent techniques, mutual impedance and relaxation probes had shown the presence of a low ionospheric layer around the altitude of ~60 km, with a conductivity peak of ~2-3 nS/m. This ionized layer produced mainly by galactic cosmic rays is found at a slightly lower altitude than predicted by current models. We review the results obtained with the two concurrent measurements and, in particular, we discuss the observed steep vertical gradients and fine structure of the conductivity profile that could be due to the presence of aerosols. In passive mode the instrument detected an Extremely Low Frequency signal that is likely related to a Schumann electromagnetic resonance in Titan's ionospheric cavity. Models of the cavity have been built with the assumption of a ground conductivity of ~1nS/m as measured on the landing site for estimating the depth of a possible subsurface ocean.

SUN-EARTH RELATION: HISTORICAL DEVELOPMENT AND PRESENT STATUS- A BRIEF REVIEW

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The Sun and Earth are intimately related. A few decades ago, it was assumed that the relationship was only through the incidence of solar visible and infrared radiation on the surface of the Earth. However, it was soon realized that many powerful solar radiations reached the top of the terrestrial atmosphere but got absorbed in the upper part of the atmosphere, causing significant changes in the terrestrial environment. In this review, various processes are described, first on the Sun where various solar structures evolve, later in the interplanetary space due to escaping solar wind, and further in the interaction of the solar wind with the Earth's magnetic field, containing it in the magnetosphere and entering through the neutral point in the magnetotail. Resulting phenomena like auroras, ring current etc. are described. Present status of solar and interplanetary environments and their terrestrial effects is briefly outlined.

A HYBRID APPROACH IN FOF2 FORECAST MAPPING INCLUDING HALLOWEEN STORM

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Ionospheric F layer critical frequency, foF2, is a parameter designating the maximum usable frequency. In addition to diurnal, seasonal and solar variability of foF2, during disturbed conditions induced by Solar Storms, the physics of Ionosphere become more complex and non-linear. There are various models constructed for the forecasting

of foF2 using different methods. In this paper, a Fuzzy-Neural Network approach is employed for forecasting during one of the major storms, Halloween 2003 storm. Since the location of ionosondes are fixed, there are distinct points for measurement. Several attempts were done for instantaneous mapping foF2. In this paper, coupling with Fuzzy NN, a Genetic Programming approach is employed for the generation of a general mapping function for forecast mapping of foF2.

OBSERVATIONS OF H ALPHA LINE PROFILES IN BE STARS USING 45 CM CASSEGRAIN TELESCOPE AT ARTHUR C CLARKE INSTITUTE IN SRI LANKA

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We observed 13 Be starts (visual magnitude less than 6.9) using 45 cm Cassegrain telescope at the Arthur C Clarke Institute, Sri Lanka during the period of August 2005 to March 2006. High resolution spectra of these Be stars were obtained using 1200 lines/mm reflective grating in first order with resolution $R=\lambda/\Delta\lambda=76800$ and linear spectral dispersion 0.31Å per pixel at 6563Å. Data reduction was carried out using IRAF (Image Reduction & Analysis Facility) and H alpha line profiles of the stars were obtained.

Past observations on HR5941 show that V/R ratio of H alpha line profile is less than 1. Our present study shows that V/R ratio has increased to 2.12. This is a reversal of violet and red peak intensities and can be ascribed to slow apsidal motion of the gas in the elliptical ring. Shape of the line profile HR 6118 has changed from a triple peak to wine bottle type as seen in the previous studies. We observed this as a symmetric Gaussian profile. The low v_{sini} (140 km/s) implies HR 6118 should be a pole-on star and our observed line profile clearly shows this fact. Observed HR2284 profile is a wine bottle type profile which is caused by the non-coherent scattering broadening (NSB) of the optical thickness of H alpha line radiation. We developed a software code based on peak reconstruction line profile derivative method to detect the hidden peaks on wine bottle type line profiles. This method was applied to the spectra HR 2284, HR 6712 to separate the hidden peak.

We found a good correlation (0.8) between FWHM and vsini. Keplerian motion of the gas in the ring is a major factor for the width of the line profile. When the stellar rotation velocity (v_{sini}) increases the projected Keplerian velocity ($V_{k,sini}$) of the disk increases and thereby increases the FWHM. The strong correlation 0.96 between Ip/Ic and equivalent widths found in our observed line profiles conform the definition of the equivalent width.

ULTRA VIOLET C ON THE EARTH SURFACE AND WILDFIRES EARLY DETECTION

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The need of early forest fires detection is obvious because the wildfire doubles its aria every few minutes. The main idea is the development of fire warning network which will cover a large forest aria and will be no man working during a few years. Each node of the network will work over an area of one square kilometer and will detect the fire by an optical method just when the fire flames.

Related to this application characteristics of different types of detectors working in the Ultra Violet C spectral range will be discussed, namely: spectral response, sensitivity, power consumption, easy to driven, etc.

The attenuation in the atmosphere of the UVC radiation at different wave lengths coming from the sun and the fire will also be discussed in terms ofmaximum aria to be covered by one node of the fire warning network.

THEMATIC INVESTIGATION OF FRAUNHOFER LINE DYNAMICAL CHARACTERISTICS FOR THE NEEDS OF PLANT FLUORESCENCE MONITORING

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Solar spectrum investigations have been always the most powerful source for information in the remote sensing activities. Spectral characteristics of reflected solar radiation supply data for numerous Earth Observation Systems. Significant part of

contemporary space missions/instrumentation/ is dedicated to global monitoring for vegetation biomes through reflected sunlight registration in visible and near infrared spectral ranges. Scientific researches of recent years propose a new method to observe plant bioactivity from space using fluorescence signal detection and imaging. Although highly informative, the fluorescence emission intensity is a very week signal and the only opportunity to exploit its sensitiveness and rapidity is to retrieve it from remaining low-level sun radiance in appropriated solar and/or telluric Fraunhofer lines. This task inspired authors' team to start a set of experiment dedicated to profound investigation of specific Fraunhofer lines suitable for upcoming fluorescence registration missions.

Authors present their results from the first set of measurements in the blue-green range. High-resolution spectral measurements track out CaI and HIrlines dynamics. Spectral characteristics of investigated lines were registered with High-resolution spectrometer HR 4000, OCEAN OPTICS. Several atmosphere parameters were measured simultaneously with sunphotometer MICROTOPS II: air mass, aerosol optical thickness, direct solar irradiance in five channels and water vapour column. Tables and charts visualise experiment results, namely the changes of lines' shape, amplitude and spectral positions. Authors describe the dynamic range of data variation and analyse its dependence on atmosphere parameters, sunlight intensity and zenith angle.

EFFECTS OF LONG-TERM LOW-FREQUENCY ELECTROMYOSTIMULATION TRAININGS SKELETAL MUSCLE DURING "DRY" WATER IMMERSION

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Gravitational loading appears to be necessary for the maintenance of human lower limb skeletal muscle size and force (Kubo et al., 2000; Koryak, 2001). Studies simulating microgravity have shown that exercise countermeasures can attenuate, but not completely prevent the loss of muscle mass and force (Akima et al., 2001; Koryak, 2001). Most notable after exposure to microgravity is a disproportionate loss of force as compared to that of muscle size (LeBlanc et al., 1988; Kawakami et al., 2001), indicating that factors other than atrophy contribute to muscle weakness. The internal architecture of a muscle is an important determinant of its functional characteristics (Gans, Bock, 1965). The goal of study was to investigate the internal architecture (pennation angle - Θ, fibre length - L) of the triceps surae [medial (GM) and lateral (LG) gastrocnemius and soleus (SOL) muscles] in relation to the functional characteristics of the plantarflexors after 6 d of «*dry*» water immersion (DI) with exercise countermeasures (low-frequency functional electrical stimulation training — FES). Four men-volunteers (22.8 ± 0.8 yr, 1.84 ± 0.1 m, and 79.3 ± 4.2 kg) gave their written, informed consent to participate in this study. To simulate microgravity the DI model has been used. The FES is performed during 3 hours/day with 1 s « *on* » and 2 s « *off* » trains at intensity levels of 20-30 % of maximum tetanic force and a frequency of 25 Hz. A real-time B-mode ULT apparatus («SonoSite MicroMaxx», USA) with a 7.5-MHz linear-array probe was used to obtain sagittal images of the GM, LM and SOL, at rest and at 50 % of plantarflexor isometric maximal voluntary contraction (MVC) at the neutral ankle position. Each subject's right foot was firmly attached to an dynamometer («BIODEX», USA). The subjects were verbally encouraged to perform static contractions with the ankle plantarflexor with a maximum possible effort. Three contractions were performed by a 1 min rest interval between bouts and the highest value was considered the MVC. Θ was defined as the angle created by the echoes from the fascicle and their insertion into the aponeuroses; L was measured as the length of the line drawn along the echoes parallel to the fascicles from the deep up to the superficial (Fukunaga et al., 1997). The angle between the fascicles echo and the aponeurosis echo was defined as the muscle's (Fukunaga et al., 1997). Both fascicle L and Θ were reduced after DI, this strongly suggests a loss of both in-series and in-parallel sarcomeres, respectively. The loss of in-series sarcomeres would mean that this is likely to have implications both on the *force-length* and *force-velocity* relationships of the muscle. The reduced initial resting Θ probably, grows out reduction decreased tendon stiffness or of the muscle-tendon complex. In conclusion, first, that the architecture different lead the muscle considerably differs, reflecting, probably, their functional roles, second, various changes L and Θ fibres between different muscles,

probably, are connected to distinctions in ability to develop force and elastic characteristics of sinews or muscle-tendon complex.

THE EFFECT OF THE ELECTRON COLLISIONS ON THE HF RADIO WAVE AMPLITUDE VERTICALLY TRAVELLING IN IONOSPHERE

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The behavior of the electromagnetic wave in any medium is possible with the solution of the components of electric and magnetic field and to be known the parameters of medium. In this study, the propagation of high frequency (HF) radio waves vertically travelling in the ionosphere is analyzed. Taking into account electron collisions, the amplitude of the electric field is assessed in terms of ionospheric plasma parameters. The numerical values needed for this assessment are obtained from the International Reference Ionosphere (IRI) Model. The wave amplitude variation in terms of altitude, season and wave frequency is shown. Calculations show that the variations of the wave amplitude are different for every wave frequency. The electron collisions have been decreasing the amplitude of the electromagnetic wave.

INVESTIGATION OF IONISING RADIATION DISTRIBUTION IN A HUMAN PHANTOM ABOARD THE INTERNATIONAL SPACE STATION

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Liulin-5 is a charged particle telescope developed for investigation of the radiation environment dynamics within the Russian spherical tissue-equivalent phantom on the International Space Station (ISS). Liulin-5 experiment is an adherent part of the international project MATROSHKA-R on ISS. MATROSHKA-R project aims to investigate the space radiation doses distribution at the human bogy using human models –tissue – equivalent phantoms. The instrument Liulin-5 measures energy deposition spectra, linear energy transfer (LET) spectra, flux and absorbed dose rates for electrons, protons and the biologically relevant heavy ion components of the cosmic radiation at different depths of the phantom's radial channel.

Since 28 June 2007 the experiment Liulin-5 runs continuously aboard ISS. Data is recorded automatically on memory cards and cards periodically are transported back to ground. Presently data is available for the period 28 June-16 October 2007. In this report we present preliminary results of analysis of the data available which includes the depth dose distribution and LET spectra measured along the trajectory of ISS.

HIGH RESOLUTION SPECTROSCOPIC MEASUREMENTS OF THE O_2 (1,0) ATMOSPHERIC SYSTEM BAND ROTATIONAL ABSORPTION LINES

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The rotational absorption lines from the P branch of the molecular oxygen atmospheric system (1,0) band have been used for the effective temperature evaluation. Ground based spectroscopic observations have been performed during June/July 2006 at the solar telescope of Belgrade Astronomical observatory. 20 observational sets have been done during this period. Every set consists of the averaged over 5 measurements CCD images of the doublets of the lines with rotational quantum numbers J from 1 to 25. The signal to noise ratio has been discussed and finally estimated about 400. A synthetic spectrum of the (1,0) band has been created based on line-by-line calculations, which has allowed to compute the theoretical equivalent widths. Typical summer temperature profiles have been used. The case of strong absorption has been assumed. The theoretical and measured line profiles and their equivalent widths have been compared. The dependence of the equivalent widths on the rotational quantum number has been

worked out. The possible contaminations in some cases are discussed. The theoretical estimates and the measurement results have been examined.

THE PHOTOCURRENT IMPACT ON PLASMA MEASUREMENT ONBOARD `ICB-1300` SATELLITE

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The photocurrent impact on the space plasma parameter investigation "Intercosmos Bulgaria - 1300" (ICB-1300) was processed. The data from the cylindrical Langmuir probe (CLP) was analyzed synchronous with satellite orbit parameters. The regions of unusual changes and orbit terminator was explored and studied. There was found the orbits with a specific CLP changes pointing to the photocurrent influence on the registering of the space plasma parameters. The charts with the spatial cases of changes in the registered plasma parameters, synchronized with the satellite orbit parameters was shown. Conclusion about the photocurrent impact on the plasma measurement was done.

PROBE INSTRUMENT FOR THE INTERNATIONAL SPACE STATION

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Two probes are included in the Plasma-Wave Complex "Obstanovka" ("Environment" in Russian) to be operated aboard the International Space Station (ISS). The Plasma-Wave Complex consists of multiple units for measuring thermal plasma parameters, electromagnetic parameters, ISS potential Us, electron spectra, spectra of VLF electromagnetic fluctuations.

The parameters measured by two identical probes are the electron and ion concentrations Ne and Ni in the range 1.109 – 1.1013 m^{-3}, the electron temperature Te from 1000 to 6000 K, and the space station potential Us in the range from -100 V to +100 V. There are two main modes of operation: "full", for measuring Te, Us, Ne and Ni, with time resolution 1 s, and "fast" for measuring the fluctuations of the plasma concentration, with frequency 200 Hz. The presence of two identical instruments mounted in two different points allows the determination of space variations of Ne, Ni, Te and Us in the near surface zone. In this paper the probes for `Obstanovka" experiment are described, including a more reliable method for the sweep voltage generation, an adaptive algorithm for the probe's operation, and the possibility for remote upgrading of the instrument from the ground.

COLORS OF THE ECLIPSED MOON - EFFECTS OF STRATOSPHERIC TRANSPARENCY AND SOLAR ACTIVITY

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Solar activity influence on the colour of the moon during a total lunar eclipse is considered in the work.

The umbra is always sufficiently dark to the naked eye, the fully eclipsed part of the lunar disk appears almost black in contrast to the uneclipsed portion. Only in a total lunar eclipse, during the phase of totality itself, can the color of the illuminated disk become a reliable indicator of stratospheric turbidity.

Colors other than red can also appear during a total lunar eclipse, especially near the moon's rim. Although this fact has been known since ancient times, modern methods of reporting eclipse colors have ranged from traditional, simple visual descriptions to more objective photometric measurements.

Catalogue of the observed colors during the 1960–2008 period has been made in the Yuri Gagarin Public Astronomical Observatory and Planetarium, Stara Zagora. Usable eclipses' number is 36. The hue and intensity of the faint illumination of the lunar disk during totality yield a measure of the aerosol optical depth of the Earth's stratosphere. This period under study showed a relatively clear stratosphere at nearly all times.

Physical phenomena in the earth's atmosphere, which have an effect on the earth's umbra structure are discussed. Heterogeneous colour of the moon during a total eclipse is connected with stratospheric structures of different physical state.

Good correlation between the solar idices and colour of the eclipsed Moon, estimated by the Danjon scale serve as a proof of the solar activity and stratospheric phenomena connection.

STATISTICAL RELATIONSHIP OF THE NO2 SLANT COLUMN AMOUNT OVER STARA ZAGORA STATION AND THE SOLAR F10.7 FLUX WITH CONSIDERATION OF THE QBO PHASE

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By means of the GASCOD spectrometer at Stara Zagora station (42.8N, 26.1E), data series were obtained of monthly NO2am (at sunrise) and NO2pm (at sunset) slant column amounts (SCA), covering the interval from September 1999 to the end of 2006. After removing the seasonal cycle, relationships between the NO2am and F10.7 solar flux and NO2pm and F10.7 were sought. No statistical significant correlations were found unless the QBO phase was taken into consideration. The original data series of the quasi-biennial oscillations (QBO) at the level of 30 h Pa have been used to study the relation between the NO2 and the F10.7 taking into account the QBO phase. The data have been separated into two different groups – positive (westerly) and negative (easterly) QBO phase. As a result, during the negative QBO phase the relationship between NO2pm and F10.7 and between NO2am and F10.7 appears statistically significant at level $p = 0.01$. During the positive QBO phase, NO2am shows a statistically significant correlation with F10.7 ($p = 0.05$) whereas NO2pm do not. The statistical significance of the found relationships was determined by means of Student's t-test.

A CASE STUDY OF AN UNUSUAL BEHAVIOR OF NEUTRAL HE AND O DENSITIES AT ~830KM HEIGHT OVER ONGOING EARTHQUAKE (GUAM JANUARY 04 1982) BY MEANS OF DYNAMICS EXPLORER-B SATELLITE DATA

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In the present work, Dynamics Explorer-2 (DE-2B) data from the Neutral Atmospheric Composition Spectrometer (NACS), Vector Electric Field Instrument (VEFI) and Retarding Potential Analyser (RPA) were used to study selected case of possible ionosphere-thermosphere response associated with ongoing seismic event at Guam Island on January 04 1982. Satellite Dynamics Explorer-B was launched on August 3 1981, with an initial orbital inclination of 91°, perigee ~300km and apogee ~1000km. On board instrumentation had been addressed to study the thermosphere-ionosphere-magnetosphere coupling processes. We examined entire DE-B database in respect to the earthquakes with magnitude M>4.0 in order to search seismic effects on the local ionosphere and/or thermosphere parameters. In a single case, it was found an increased neutral He and O densities at 830km altitude, preceding Guam earthquakes at 0605UT on 4 January 1982 with M=6.1 magnitude of the main shock and two aftershocks with M=5.8 and M=5.4 respectively. At the maximum of the neutral density bulge, He and O densities are of about 55% higher than the observed mean value over the same latitudes from the few lateral orbits before and after the earthquake. In conclusion, we discuss a possible sources of such an enhancement of neutral He and O at these heights over the earthquake zone.

INTER-ANNUAL OZONE VARIATIONS AT EUROPEAN HIGH LATITUDES, STUDIED BY OZONE LIDAR AND OZONE SONDES

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The geographic area at high latitudes north of the polar circle is characterized by long darkness during the winter (polar night) and by a long summertime insolation (polar day). In winter the polar vortex is formed as a consequence of the temperature decrease. Near its edge, the strong polar jet acts as a barrier for horizontal transport in a region with strong potential vorticity gradients. The ozone density in the lower and middle stratosphere are controlled by both chemical destruction processes and transport processes.

To study the inter-annual ozone variation at high latitudes, we examine ozone vertical distributions from the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR) (69.3°N, 16.0°E), a station at Andenes, and from the stations at Sodankylä (67.4°N, 26.6°E) and at Ny-Alesund (78.9°N, 11.9°E). The data sets cover the time period from 1994 up to 2004. Additionally, the results are completed by HALOE minor constituent profiles. In late winter and early spring, we find a secondary ozone maximum near 13 -15 km, between the tropopause and the absolute ozone maximum near 17- 20 km. The maximum is built up by the combination of air mass transport and chemical ozone destruction above. This is mainly caused by the NO_xcatalytic cycle, which begins after the polar night and intensifies with the increasing day length. We observe the formation of a troposphere inversion layer. The inversion layer is wider and reaches to higher altitudes in winter than in summer. However, the temperature inversion during summer is stronger. We observe enhanced ozone number density during the spring-summer period. Ozone is either accumulated or decreased by synoptic weather patterns just above the tropopause from spring to summer. In the seasonal average, an ozone enhancement above the tropopause is obtained.

The stronger temperature inversion during the summer period inhibits the vertical stratosphere-troposphere exchange. Furthermore, the horizontal advection in the upper troposphere and lower stratosphere increases during the summer. The combination of these mechanisms generate a layer with a very small ozone number density above the troposphere inversion layer from June/July up to the late autumn.

AURORAL RESPONSES TO SOLAR WIND DYNAMIC PRESSURE PULSES UNDER THE DIFFERENT IMF BZ ORIENTATION: CASE STUDIES

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Large and fast solar wind dynamic pressure pulses can lead to important large-scale disturbances of the magnetosphere-ionosphere system. The effects from the solar pressure increase will be extensive if southward IMF accompanied the solar wind dynamic pressure enhancement. We compared auroral responses to the large and fast solar wind dynamic pressure pulses accompanied by northward and southward IMF orientation. We found that growth of the solar wind pressure during northward IMF leads to an enhancement of the luminosity intensity at the dayside of auroral oval. Otherwise increase in solar wind pressure during weak southward IMF can serve as a trigger for the pseudobreakup onset. Case studies have shown that large solar wind pressure pulses accompanied by strongly southward IMF and arrived during substorm growth phase triggered substorm onset. Pressure pulses under the southward IMF condition arrived after substorm onset produced strong dayside auroral activation, which moved and merged together with substorm current wedge, resulted in the further intensification of substorm.

AN INSTRUMENT AND SENSORS FOR ELECTRIC FIELD MEASUREMENTS IN WIDE FREQUENCY RANGE ON BOARD OF SATELITES

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The measurement of electric fields and waves on board of satelites is mainly done by a double probe method. The measurement is performed using the potential difference between couples of sensors immersed in plasma. To measure the field vector three components are needed. Similar measurements of DC up to frequences 20-30 kHz are routine when investigating the flow processes in the plasma and are ade on board of many satelites.

In order to solve the scientific problems of the new project RESONANCE it is necessary to perform measurements in a wide frequency range of DC up to frequences 1MHz, both of magnetic and electric fields and waves.

In this work a development of electric sensors and device for detection and data processing of the signals is presented. An analysis of the interaction sensor-plasma, requirements to the sensor construction of the device for processing of the signals and their distribution towards onboard analysers are also presented.

ADOPTION OF ELMAN RECURRENT NEURAL NETWORKS FOR RECONSTRUCTION OF GEOMAGNETIC DATA SET REGISTERED AT SWIDER OBSERVATORY IN PERIODS OF INCONSISTENT OR MISSING DATA

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The paper describes examples of the artificial neural networks (ANN) adoption to reconstruct missing data and incorrect registration during some periods. In our previous paper the recently digitized hourly geomagnetic data of H component registered at Polish station Swider (geogr. lat. 52.12, geogr. long. 21.25) have been compared with data of Niemegk and Rude Skov for the whole interval 1921-1967 of the registration. This analysis has generally showed the good quality of the Swider H component records that agreed with the results of other stations. We have found only small inconsistencies during 1927-1928 and 1933. In the present study we make an attempt at the improvement of inconsistent data set during the period 6 Dec 1927 - 25 Mar 1928 and filling two data gaps: 12 - 24 Jun 1929 and 11 - 30 Jun 1950 using the Elman ANN. Hourly means of H component registered at Rude Skov (RSV), Niemegk (NGK) and Swider (SWI) stations were taken into account. Data from the continuous recording RSV station have been used as training of the Elman ANN, validation and test sets.

The trained ANN was then used to obtain sets which would replace the missing or incorrect SWI data. The predicted records by the network have been compared with NGK data from the same periods by means of the correlative analysis and the wavelet technique with establishing of the significance levels of the resultant power spectra and wavelet coherence. These analyses show that Elman ANN adoption is the successful technique for data improvement.

CONTINUOUS MEASUREMENT DURING THE ACTIVE SPACE EXPERIMENTS

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Continuous measurement during leading of the active space plasma experiment is discussed. Some pass active ionosphere missions are brought to light. The active space plasma experiments algorithm timing and his execution are considered. The problems with the reliability and fault resistance of the space mission equipment during executing of the main active experiments are analyzed. There is propounded a solutions for electromagnetic field investigations instrumentations and space structure body potential tracking systems.

SIMULATION OF THE OPTIMAL SIZE OF PHOTOVOLTAIC SYSTEM USING HELIOPHYSICAL VARIABLES.

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A method of simulating the optimal size of photovoltaic systems based on the observed time series of some heliophysical variables was developed and explored in this research. The data used were the sunshine duration and solar radiation intensity for years 1990 to 2004 for eleven Nigerian stations: Calabar, Ibadan, Ilorin, Kaduna, Kano, Lagos, Lokoja, Maiduguri, Minna, Sokoto and Zaria obtained from the archives of the Nigeria Meteorological Agency. Appropriate programs were developed using Matlab^R code to model the optimal size of a photovoltaic system. Input parameters which were estimated from the obtained heliophysical variables and used in the simulation were clearness index and total radiation on an inclined surface. The output parameters include utilizability, monthly-average fraction of the load covered by the photovoltaic system with battery storage, monthly-average fraction of the load covered by the photovoltaic system without battery storage, monthly-average of uncovered load fraction of the photovoltaic system, area of the panel, optimal area of the panel, total cost of the panel and the optimal total cost of the panel. Maximum incident solar radiation onto the photovoltaic array is obtainable in dry season which lead to better performance of photovoltaic electrical output associated with lower values of utilizability and smaller sizes of photovoltaic system while minimum incident solar radiation onto the photovoltaic array were witnessed during the wet season which lead to poor performance of the photovoltaic electrical output associated with higher values of utilizability, larger sizes of photovoltaic system and it determines the optimal size of the photovoltaic system. This research averaged the cost of the optimized plant, capable of supplying 15 kW, at #809,800. A comparison of the researched optimized cost with PHCN (Power Holding Company of Nigeria) current charge indicated that after one year and six months, the user of the photovoltaic plant will become a free user of electricity. The optimized photovoltaic plant is short term cost effective and much cheaper than the non – optimized plant.

IONOSPHERIC IRREGULARITIES AND THEIR INFLUENCE ON PLASMA PARAMETER MMEASUREMENTS BY LANGMUIRE PROBES

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Cylindrical Langmuire probes are widely used for plasma density and temperature measurements. During such probe measurements, fulfilled on board of INTERCOSMOS-bulgaria-1300 satellite, a Volt-Ampere characteristics with extraordinary shapes were sometimes observed. In this report it will be shown that thanks to uneven distributions of plasma parameters inside irregularities, the Langmuir probe V/A curves whose execution time period happened to be close to time intervals used by satellite to pass through such irregularities are subjected to some characteristic distortions. Possible ways to originate these irregular structures will be discussed and it will be shown that sources for these structures can be situated in the magnitosphere or in the ionosphere