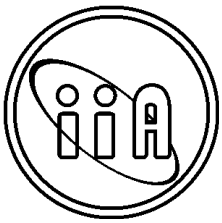
2nd UN/NASA Workshop on International Heliophysical Year and Basic Space Science

Indian Institute of Astrophysics, Bangalore
27 November – 1 December, 2006



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2nd UN/NASA workshop on International Heliophysical Year and Basic Space Science
November 27 – December 1, 2006
Indian Institute of Astrophysics, Bangalore, India

Programme

Monday, 27 November 2006

Inaugural session

Chair: S. S. Hasan

09:30 ***Welcome:***
09:40 ***Presentation of bouquets & Lighting of lamp***
09:45 ***Introductory remarks:***
09:55 ***Keynote address:***
10:25 ***Logistics & Vote of thanks:***

10:30 – 11:00 hrs Tea/Coffee Break

Session 1: IHY Overview-I

Chair: C. Amory-Mazaudier

11:00 J. Davila: *IHY Overview: Science, Observatory Development, Outreach and history*
11:20 H. Haubold: *UNBSSI Program: A Historical Introduction*
11:40 N. Gopalswamy: *IHY and UNBSSI Program: Success Stories*
12:00 M. Guhathakurta: *International Living With a Start (ILWS) and IHY*
12:20 B. J. Thompson: *IHY Coordinated Investigation Programmes (CIPs)*
12:40 R. Smith: *Heliophysics in the United States of America*

13:00 – 14:00 hrs Lunch Break

Session 2: IHY Overview-II

Chair: B.J.Thompson

14:00 P. K. Manoharan: *IHY activities in India*
14:20 A. B. Rabiu: *IHY activities in Africa*
14:40 K. Georgieva: *IHY activities in the Balkan-Black-Caspian Sea Area*
15:00 H. M. K. Al-Naimiy: *IHY activities in West Asia*
15:20 A. R. W. Hughes: *IHY activities in South Africa*

15 :40-16:00 Tea/Coffee break

Session 3: Solar surface phenomenon

Chair : A. R. Choudhuri

16:00 R. Erdelyi: *Solar magnetic waves and oscillations*
16:20 K. R. Sivaraman: *Measurement of solar diameter*
16:40 A. Ambastha: *Signatures of large flares on photospheric magnetic and velocity fields*
17:00 K. Sankara Subramanian: *Fine scale magnetic fields in and around a decaying active region*
17:20 P. Chatterjee: *Forecasting cycle 24 with a solar dynamo model*

17:40 Adjourn

18:00 Departure to Grand Ashok: Cultural program and IIA Director's dinner.

Tuesday, 28 November 2006

Session 4: Chromosphere and transition region dynamics

Chair: C. Uberoi

09:00 S. S. Hasan: *Dynamics of the magnetized solar chromosphere*
09:20 K. Wilhelm: *Lessons from the SUMER/SOHO solar ultraviolet spectrograph*
09:40 R. Kariyappa: *Contribution of solar chromospheric fine scale features to UV irradiance variability*
10:00 D. Banerjee: *Multi-wavelength study of active region loop dynamics*
10: 20 P. Venkatakrishnan: *Multi application solar telescope – A versatile tool for studying the physics of solar eruptions*
10:40 L. Dame: *Chromosphere and transition zone dynamics and heating: Need for future space missions*

11:00-11:20 Tea/Coffee break

Session 5: Coronal Studies

Chair: J. M. Davila

11:20 T. Sakurai: *Observation of CME source regions by coronal emission line dopplergrams*
11:40 J. Singh: *Magnetic nature of coronal loops*
12:00 S. Ananthakrishnan: *GMRT and solar radio observations*
12:20 K. R. Subramanian: *Variations in the global solar radio flux during the extreme solar eruptions of October-November 2003*
12:40 P. Subramanian: *Electron acceleration in solar noise storms*

13:00 – 14:00 hrs Lunch break

Session 6: Corona and Interplanetary Medium - I

Chair: T. Sakurai

14:00 R. Jain: *SOXS for IHY 2007 and beyond*
14:20Y.-J. Moon: *Sun-Earth connection studies at KASI*
14:40 B. N. Dwivedi: *Propagation and dissipation of MHD waves in coronal holes*
15:00 M. D. Popescu: *Observational clues to the origin of fast solar wind*
15:20 V. Krishan: *Short scale magnetic turbulence in the solar wind*

15:40 – 16:00 hrs Tea/Coffee break

Session 7: Corona and Interplanetary Medium - II

Chair: S. Ananthakrishnan

16:00 N. Srivastava: *On the slow rise phase of eruptive quiescent solar prominences*
16:20 N. Gopalswamy: *CMEs in the Heliosphere*
16:40 P. K. Manoharan: *Solar wind studies: Transients and steady-state flows*

Session 8: Terrestrial atmosphere - I

Chair: U. Inan

17:00 G. S. Lakhina: *Solar energetic particle events and geomagnetic storms*
17:20 B. M. Reddy: *Solar influences on terrestrial ionosphere and radio communications*
17:40 P. B. Rao: *Radar studies of ionospheric plasma irregularities*
18:00 J. H. Sastri: *Physical processes underlying the equatorial effects of solar wind dynamic pressure variations*
18:20 R. Sridharan: *Interplay between the equatorial geophysical processes*

18:40-19:30 DVD show from NASA HQ and free time for discussions

19:30 hrs Dinner at IIA

Wednesday, 29 November 2006

Session 9: Terrestrial atmosphere - II

Chair: J. H. Sastri

09:00 A. Bhattacharya: *Effect of solar variability on the evolution of equatorial spread F*
09:20 S. Gurubaran: *Long term variabilities of planetary scale waves in the mesosphere-lower thermosphere region*
09:40 D. Narayana Rao: *Radar and lidar probing of the atmosphere*
10:00 E. Y. Kassie: *A tomographic reconstruction technique applied to the GPS TEC data*

10:20 – 10:40 hrs Tea/Coffee break

Session 10: Non-extensive statistical mechanics

Chair: H. Haubold

10:40 A. M. Mathai: *Generalized measure of entropy, Mathai's distributional pathway model, and Tsallis statistics*
11:10 Jiulin Du: *Test of Non-extensive statistical mechanics by the solar sound speeds measured in helioseismology*
11:40 R. Pandit: *Systematics of dynamo action in a shell model for magnetohydrodynamic turbulence*

Session 11: Instrument donors - I

Chair: N. Gopalswamy

12:10 C. Monstein: *CALLISTO radio spectrometer*
12:30 S. Ueno: *Chain-project and installation of flare monitoring telescopes in developing countries*
12:50 K. Yumoto: *Magnetic data acquisition system (MAGDAS) for IHY 2007*

13:10 – 14:10 hrs Lunch break

Session 12: Instrument donors - II

Chair: A. Bhattacharya

14:10 C. Amory-Mazaudier: *Geophysics integrated studies in the Sun-Earth system: A co-operative project of Vietnam, Europe and Africa*
14:30 K. Groves: *Expanding the SCINDA network for IHY 2007*
14:50 T. Garner: *Preliminary observations of ionospheric structures using ground receivers and the COSMIC radio beacon*
15:10 U. Inan: *VLF remote sensing of the lower atmosphere with AWESOME receivers*

15:30 – 16:00 hrs Tea/Coffee break

Session 13: Instrument donors - III

Chair: S. Gurubaran

16:00 J. H. Fernandez: *Southern atlantic magnetic anamoly (SAMA) monitoring through installation of small magnetometer network in the Brazilian territory*
16:20 S. G. Kanekal: *High latitude energetic particle boundaries: The SAMPEX database*
16:40 R. A. Schwartz: *Prospects for GDL and solar software*

17:00 Adjourn

Free evening

Thursday, 30 November 2006

Session 14: Instrument hosts - I

Chair: R. V. Bhonsle

09:00 P. K. Manoharan: *CALLISTO radio spectrometer at Radio Astronomy Center, Ooty*
09:20 R. Singh: *Very low frequency studies of ionospheric/magnetospheric electromagnetic phenomena in Indian low latitude region using AWESOME receivers*
09:40 K. Georgieva: *SEVAN – Neutron monitor network*
10:00 T. Djamaluddin: *Preparation of IHY 2007 in Indonesia*
10:20 A. Kebede: *Space, atmospheric physics education and research at North Carolina A&T State University*

10:40 – 11:00 hrs Tea/Coffee Break

Session 15: Instrument hosts - II

Chair: H. M. K. Al-Naimiy

11:00 A. T. Al Mousli: *Astronomy in Syria*
11:15 J. K. Ishitsuka: *A solar station for education and research on solar activity at a national university in Peru*
11:30 E. G. Dountio: *Radiative transfer model in the atmosphere and experimental solar data of Yaounde location*
11:45 N. Seghouani: *High resolution spectral analysis for irregularly sampled helioseismic data*
12:00 J. T. Nugroho: *Indication of solar signal in Indian ocean dipole phenomena over Indonesia*
12:15 N. M. R. Al Ubaidi: *A developed numerical mapping technique*

12:30 J. O. H. Ndeda: *Determination of coefficient of correlation between radiation and relative humidity and equation of line of best fit using statistical methods*

12:45 – 14:00 Lunch break

Session 16: IHY Science in developing countries

Chair: A. B. Rabiu

14:00 A. Mahrous: *The gap in global ionospheric and heliospheric measurements over Africa: our proposals for IHY 2007*
14:15 S. Krasotkin: *Space sciences education and outreach project of Moscow state university*
14:30 B. Damtie: *Optimal long binary phase code-mismatched filter pairs with application to ionospheric radars*
14:45 Z. A. Abdul Rashid: *Influence of solar energetic phenomena on GPS PWV during the major storm of 2003 at Scott base station, Antartica*
15:00 N. Gopalswamy: *General discussion on donor programs*

15:30 – 16:00 Tea/Coffee Break

Session 17:

16:00 Panel discussion on International Collaboration

Session 18:

17:00 Panel discussion on Future IHY/UNBSSI Workshops

18:15 Adjourn

18:30: Departure to Hotel Royal Orchid: ISRO Chairman's dinner.

Friday, 1 December 2006

Session 19: Virtual Observatories

Chair: R. Schwartz

09:00 G. Eichhorn: *Searching the scholarly literature made easier*
09:20 B. J. Thompson: *IHY-CAWSES data base*
09:40 J. Murthy: *Center for astronomical data and software at IIA*

10:00 Open Discussion on Data usage in developing countries

10:30 – 11:00 hrs Tea/Coffee break

Session 20: Concluding session

Chair: H. Haubold

11:00 – 13:00 hrs

13:00 - 14:00 hrs Lunch

END

Contents:

Inaguration: 09:30 – 10:30, Nov. 27, 2006

1. Welcome
2. Presentation of bouquets & Lighting of lamp
3. Opening remarks
4. Keynote address
5. Logistics/Vote of thanks

Session 01: 11:00 – 13:00, Nov. 27, 2006

International Heliophysical Year (IHY) Overview: Science, Observatory Development, Outreach and History

J. M. Davila*
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In 1957 a program of international research, inspired by the International Polar Years of 1882-83 and 1932-33, was organized as the International Geophysical Year (IGY) to study global phenomena of the Earth and geospace. The IGY involved about 60,000 scientists from 66 nations, working at thousands of stations, from pole to pole to obtain simultaneous, global observations on Earth and in space. There had never been anything like it before. On the fiftieth anniversary of the International Geophysical Year an international program of scientific collaboration will be conducted called the International Heliophysical Year (IHY). Like it predecessors, the IHY will focus on 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 will help 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 study of energetic events in the solar system will pave the way for safe human space travel to the Moon and planets in the future, and it will serve to inspire the next generation of space physicists.

The United Nations Basic Space Science Initiative (UNBSSI): A Historical Introduction

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Pursuant to recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) and deliberations of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), annual UN/European Space Agency workshops on basic space science have been held around the world since 1991. These workshops contributed to the development of astrophysics and space science, particularly in developing nations. Following a process of prioritization, the workshops identified the following elements as particularly important for international cooperation in the field: (i) operation of astronomical telescope facilities implementing TRIPOD, (ii) virtual observatories, (iii) astrophysical data systems, (iv) con-current design capabilities for the development of international space missions, and (v) theoretical astrophysics such as applications of non-extensive statistical mechanics. Beginning in 2005, the workshops are focusing on preparations for the International Heliophysical Year 2007 (IHY2007). The workshops continue to facilitate the establishment of astronomical telescope facilities as pursued by Japan and the development of low-cost, ground-based, world-wide instrument arrays as led by the IHY secretariat.

Wamsteker, W., Albrecht, R. and Haubold, H.J.: Developing Basic Space Science World-Wide: A Decade of UN/ESA Workshops: Kluwer Academic Publishers, Dordrecht 2004.

http://ihy2007.org

http://www.unoosa.org/oosa/en/SAP/bss/ihy2007/index.html

http://www.cbpf.br/GrupPesq/StatisticalPhys/biblio.htm

IHY/UNBSS Program: Success Stories

N. Gopalswamy*, J. Davila, B. J. Thompson, and H. J. Haubold

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The United Nations Office for Outer Space Affairs, through the IHY secretariat and the United Nations Basic Space Science Initiative (UNBSSI) is assisting scientists and engineers from all over the world in participating in the International Heliophysical Year (IHY) 2007. A major thrust of the IHY/UNBSSI program is to deploy arrays of small, inexpensive instruments such as magnetometers, radio telescopes, GPS receivers, etc. around the world to provide global measurements of ionospheric and heliospheric phenomena. The small instrument program is a partnership between instrument providers, and instrument hosts in developing countries. The lead scientist will provide the instruments (or fabrication plans for instruments) in the array; the host country will provide manpower, facilities, and operational support to obtain data with the instrument typically at a local university. Existing data bases and relevant software tools can be identified to promote space science activities in developing countries. Extensive data on space science have been accumulated by a number of space missions. Similarly, long-term data bases are available from ground based observations. These data can be utilized in ways different from originally intended for understanding the heliophysical processes. This paper provides an overview of the IHY/UNBSS program, its achievements and future plans.

International Living With a Star (ILWS) Program and IHY-2007

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Abstract yet to be received

IHY-2007: Coordinated Investigation Programs (CIPs)

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The IHY has established a set of primary scientific objectives and goals. To accomplish these goals, a wide range of Coordinated Investigation Programs (CIPs) will transpire throughout the IHY timeframe, driving towards a more complete understanding of heliophysical universal processes. The CIPs are the basic "building block" of IHY science - they are proposed by members of the IHY community, and are approved and coordinated by the IHY discipline coordinators. The aim is that the program remains under the control of the proposer(s) with the IHY CIP process providing a means of publicising the proposed work, co-ordinating access to and use of the necessary resources, and a forum for discussing the results. There are currently over 50 CIPs in the IHY database, with many more being proposed.

Heliophysics in the United States of America

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The IHY program extends from the sun to the heliopause, or from the troposphere to the center of the sun, depending on your viewpoint. The US has cooperating observatories, CIPs and interested individuals willing to participate. On the other hand, there has been very little dedicated funding for the event even though NASA now claims a heliophysics program. Seen from the US viewpoint, this disappointment in funding is moderated by the fact that there are several existing programs that are well organized to collect data relevant to IHY needs. These include national programs such as CEDAR, GEM and SHINE as well as international coordinated groups such as CAWSES, eGY and IPY. Funding is adequate in each of these areas. Given that observational activity is funded and planned to happen, the most important remaining need is to communicate and demonstrate our original Universal Processes approach.

Our task is to show how the Universal Processes approach adds important synthesis to the scientific process in programs that are happening. Hence we need to be present at workshops organized by CAWSES, CEDAR, GEM and SHINE to make our message relevant and stimulate studies focused on Universal Processes.

Equally important is our emphasis on education and outreach. In the US we are planning special summer schools on IHY and special curriculum to be used in middle and high schools. We hope to produce a major documentary movie to air on television. In both outreach and in the arenas of professional science, our main aim is communication and demonstration of the new science of heliophysics.

Session 02: 14:00 – 16:00, Nov. 27, 2006

IHY Activities in India

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This talk will review the plans and status of the available instrumentation and facilities for the India IHY program and discuss the collaborations with other countries. Some of the ongoing international collaborative researches related to the IHY program and their results will be highlighted.

IHY Activities in Africa: Current Status and Future Developments

A. B. Rabiu*, and E. E. Balogun

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The International Heliophysical Year (IHY) has already gained a global acceptance as international research cooperation. This paper assesses the current status of IHY; its organization, activities and challenges in Nigeria and THE African continent as a whole. The tremendous impact and successes of the program is highlighted. Two successful annual workshops have been held at different locations with wide national representation. A few facilities already installed or secured are presented for probable exploration and forging of partnership in research. On-going research involvement with SCINDA, AWESOME and MAGDAS are presented. With the passing of the dip equator through the country, Nigeria is presented as a region for ground observation and measurements of geo- and helio-physical variables. Ways by which Nigerian scientists are taking advantage of the opportunities embedded in the international program are exposed. Benefits of IHY including training, collaboration, workshop participation and publications, are explored.

IHY Activities in the Balkan - Black Sea - Caspian Sea Region

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The regional network of the countries in the Balkan – Black sea – Caspian sea region for space weather studies was created in June 2005 with the goal to coordinate the participation of the countries in the program of the International Heliophysical Year and to promote in the future the collaboration between them in basic space sciences. This talk will summarize the activities of the network and will present the research projects which have been proposed.

IHY activities in West Asia: 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 education, giving an example of a possible curriculum, projects, and comments on the activities that have been carried out in a few Arab countries.

We feel the need for a new communication channel among the Arab people based on our common scientific ground. ASS is, in this respect, the best possible choice in the vast cultural heritage of the Arab basin.

The final purpose is scientific and economical. Building modern and good observatories, planetariums and research centers in the region jointly by Arab astronomers and space scientists is essential and will be an excellent step toward developing astronomy and astrophysics (for research, education and knowledge).

IHY Activities in South Africa

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A brief overview of the organization of the South African Research Community and details of relevant on-going research in South Africa and Antarctica will be elaborated.

Session 03: 16:00 – 17:40, Nov. 27, 2006

Solar Magnetic Waves and Oscillations

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Recent solar and space satellite missions (e.g. SOHO, Trace) and high-resolution ground-based observations (e.g. Swedish Solar Telescope, Dutch Open Telescope) have opened new avenues for 21st century plasma physics. With unprecedented details a very rich and abundant structure of the solar atmosphere is unveiled. Revolutionary observations clearly confirmed the existence of MHD waves and oscillations in a wide range of solar atmospheric magnetic structures, commonly described in the form of solar flux tubes. The objectives of this review are to give an up-to-date account of the theory of MHD waves and oscillations in solar and astrophysical magnetic wave-guides. Since magnetic structuring acts as excellent wave guides, plasma waves and oscillations are able to propagate from sub-surface solar regions through the solar atmosphere deep into the interplanetary space. Observations and theoretical modeling of waves can provide excellent diagnostic tools about the state of solar plasma. Key examples of the various types of MHD waves and oscillations will be discussed both from observational and theoretical perspectives and the concept of atmospheric (coronal) and magneto-seismology will be introduced. The lecture will also contain a few short exercises in order to highlight the important points of the applications of solar MHD wave theory.

Measurement of Solar Diameter

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We have used the photographic images of the Kodaikanal observatory archives to measure the solar diameter. These images obtained with a 6-inch refractor form part of an ongoing programme of synoptic observations that commenced in 1914. The reduced diameter measures (annual means) completed for 4 half solar cycles show that the solar radius is anti correlated with the sunspot activity.

Signatures of Large Flares on Photospheric Magnetic and Velocity Fields

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We have studied spatial and temporal evolution of some flare productive active regions using high cadence photospheric magnetograms and Dopplergrams. In addition, chromospheric H-alpha filtergrams have been used to identify flux emergences, large proper motions and development of velocity flows in relation to the flare sites. Magnetic flux and velocity changes have been found at these sites before and after large flares. The 3-D power spectra of p-mode oscillations have been obtained using ring diagram technique. These spectra are then used to look for helioseismic response of the flares on the amplitude, frequency and width of the p-modes. In the flaring active region, p-mode power enhancement and a steep gradient in the meridional velocity are found as compared to the quiet regions. A comparison of flaring active regions has been carried out with less productive active regions.

Fine Scale Magnetic Fields in and Around a Decaying Active Region

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A very high resolution spectro-polarimetric observation of a decaying spot was observed with the Diffraction Limited Spectro-Polarimeter (DLSP). The spatial resolution achieved in this observation is close to the diffraction limit (0.18arcsec) of the Dunn Solar Telescope operated by the National Solar Observatory at Sacramento Peak, Sunspot, New Mexico. The fine scales present inside the decaying active region as well as surrounding areas of the active region will be presented. There are two interesting phenomenon observed which will be described in detail. They are: (i) There are opposite polarity loops present all around the spot and some of them do connect the main spot and the surrounding magnetic features, (ii) Canopy like structures are likely to be present in the umbral dots as well as in the light bridges present providing evidence for field-free intrusion. The conclusion from the time variation of the intensity structures of this spot is that the spot is disrupted in to several fragments by the formation of light bridges and the fragmented magnetic fields later disappear under the visible photosphere.

Forecasting Cycle 24 with a Solar Dynamo Model

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A challenge before solar physicists right now is to forecast the strength of the next solar cycle (Cycle 24). Several contrary forecasts have already been made. Most of the forecasts are based on various precursor methods. Only one forecast is based on a dynamo model (Dikpati and Gilman 2006). Since we find some aspects of this work questionable, it is desirable to have another independent forecast based on a dynamo model. We are carrying out an analysis based on our dynamo model, using a methodology different from what was used by Dikpati and Gilman (2006). We shall present the methodology of our approach and, most probably, we shall also have some results by the time of the IHY meeting.

Session 04: 09:00 – 11:00, Nov. 28, 2006

Dynamics of the Magnetized Solar Chromosphere

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This review focuses on dynamics of the magnetized solar chromosphere. In the quiet chromosphere we distinguish between the magnetic network on the boundary of super-granulation cells, where strong magnetic fields are organized in mainly vertical magnetic flux tubes, and inter-network regions in the cell interior, where magnetic fields are weak and dynamically unimportant.

Observations have firmly established the presence of oscillations in the solar chromosphere. Both the network and inter-network media show bright points (BPs), which are prominent in the emission peaks in the cores of the Ca II H and K lines. However, the dynamical and spectral properties of network and inter-network BPs are quite different. In the latter the chromospheric velocity power spectrum is dominated by oscillations having power in the 5-7 mHz range, which can essentially be regarded as acoustic waves, whereas the network exhibits low-frequency oscillations with periods 7-20 min. The qualitative properties of inter-network BPs are reasonably well understood, including their formation in upward propagating acoustic shocks that encounter downward-flowing gas. On the other hand, the physical processes that heat the magnetic network have not been fully identified. Are network BPs heated by wave dissipation and if so, what is the nature of these waves? These and other aspects relating to the dynamics and energy transport mechanisms will be discussed in detail. Furthermore, a critical assessment will be made on the challenges facing theory and the direction for future investigations, particularly in the light of the new space experiments, will be highlighted.

Lessons from SUMMER/SOHO Solar Ultraviolet Spectrograph

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Our understanding of the high-temperature solar atmosphere is to a large extent based on spectroscopic observations of emission lines and continuum radiation in the vacuum-ultraviolet (VUV) wavelength range of the electromagnetic spectrum. The VUV radiation is produced by transitions of atoms and ions, or to some extent, of molecules. The atomic and ionic emission lines have formation temperatures between 10,000 K and several million Kelvin, representative of the chromosphere, the transition region and the corona. The molecular lines and the continua originate in cooler regions of the Sun. Radiation at VUV wavelengths is strongly absorbed by the Earth's atmosphere and can only be detected with instruments on sounding rockets and spacecraft above the atmosphere. Detailed studies of the spectral radiances together with atomic physics data furnish information on the electron density and temperature of the solar atmosphere, as well as on elemental abundances, whereas Doppler line-shift measurements show bulk plasma motions, turbulence, and ion temperatures. Research in this field will be presented using measurements of the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) instrument on the ESA/NASA Solar and Heliospheric Observatory (SOHO). In addition, the instrumental technique will be briefly introduced as well as the scientific use of the data obtained over a period of ten years.

Contribution of Solar Chromospheric Fine Scale Features to UV Irradiance Variability

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The Sun is the primary source of energy responsible for governing both the weather and climate of Earth. For that reason alone one would expect that changes in the amount and type of energy Earth received from the Sun could alter weather and climate on the Earth. The variations in the UV irradiance are produced by surface manifestation of solar magnetic activity. Considering the variations in the solar UV flux may cause significant changes in the Earth's climate, understanding the physical origin of UV irradiance changes is an extremely important issue in Solar and Space Physics.

We have segregated the (i) plages, (ii) magnetic network, and (iii) intranetwork + the background regions from the Call K spectroheliograms of 1980 and 1992, observed at the National Solar Observatory at Sacramento Peak, using their histograms taken for the full-disk. The different parameters like the intensity and area of the chromospheric features, the full-disk intensity (spatial K index), and the full width at half maximum (FWHM) of the histograms have been derived from the images. The spatial K index, FWHM, and the intensity of various features have been compared to the UV irradiance measured in the Mgll h and k lines by the Nimbus7 and NOAA9 satellites and it has been found that they are correlated with the Mgll h and k c/w ratio. We established, for the first time, from the results of 1992 images and of 1980 that the FWHM can be used as a good index for measuring and describing the chromospheric activity in the K-line. The results of both 1980 and 1992 images show an anticorrelation between the intensity and area of the network elements, which confirm the earlier findings derived entirely from different data set from Kodaikanal Call K spectroheliograms analyzed for the center of the solar disc in a quiet regions for a longer time interval of 1951 to 1983 (Kariyappa and Sivaraman, 1994). During solar minimum the network is fainter but covers a larger area than during solar maximum. These results suggest that the variations in both the intensity and area of the various chromospheric features have to be taken into account in irradiance models.

Multi-Wavelength Study of Active Region Loop Dynamics

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Observations have revealed the existence of weak transient disturbances in extended coronal loop systems. These propagating disturbances (PDs) originate from small scale brightenings at the footpoints of the loops and propagate upward along the loops. In all cases observed, the projected propagation speed is close to, but below the expected sound speed in the loops. This suggests that the PDs could be interpreted as slow mode MHD waves. Interpreting the oscillation in terms of different wave modes and/or plasma motions always depend on the line of sight as we observe in the limb or on the center of the disk. The JOP 165 campaign will address some of these questions. MDI and TRACE photospheric and UV imaging of TRACE and SPIRIT have been acquired simultaneously with high temporal and spatial coverage along with the spectroscopic data from CDS. EIT was operated in the shutter-less mode to achieve high Cadence. Some of the off-limb active region dynamics and oscillations observed during this JOP campaign will be focused in this presentation. Plasma condensations and temporal variations in active region loops will be also addressed.

Multi Application Solar Telescope (MAST): A Versatile Tool for Studying the Physics of Solar Eruptions

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Contemporary solar research is progressing along several fronts. Solar magnetism and its role in powering solar eruptions is one basic theme. Quantitative evaluation of the different manifestations of the free energy available for eruption is one major task. This requires vector magnetograms of a large number of active regions monitored closely in time with high polarimetric accuracy. The second task is to obtain greater clarity about various triggering mechanisms for the eruptions. This requires observations of line-of-sight magnetic fields and velocity fields with high spatial resolution. Both tasks need mutually exclusive requirements leading to the concept of the multi application telescope. In this talk, I outline the various steps, like site characterization, optical design, adaptive optics development and schemes for back-end instrumentation that culminated in the present concept of MAST. I will emphasize the constraints posed by availability of and access to technology which played a significant role in deciding the concept. I conclude by highlighting certain unique features of MAST which can provide special insights into a few scientific problems.

Chromosphere and Transition Zone Dynamics and Heating: Need for Future Space Missions

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SOHO and TRACE observations have clearly shown that even the very quietest part of the solar chromosphere is very structured and dynamic with brightenings and waves. Diagnostics from this region are very difficult because spectral lines are neither formed in LTE nor under optically thin conditions that prevail higher in the Transition Zone. The gas goes from being dominated by the gas pressure in the photosphere to being dominated by the magnetic pressure in the upper chromosphere, involving steep gradients to obtain significant dissipation or heating. The ionization balance of important elements is furthermore out of equilibrium. A proper understanding thus demands very high spatial resolution with accurate measurements of velocity and line width, uninterrupted in Space, across a broad range of temperature ("heights"), to distinguish between wave heating and reconnection events in the chromosphere and Transition Zone. Complex modeling, that ideally should include non-LTE radiative transfer in 3D including the dynamic driving in the convection zone, non-equilibrium ionization, magnetic fields, the transition region and the corona, will be necessary to understand these observations. We will discuss various aspects of this very complex problem and insist on ground measures and, above all, Future Space Missions which should better address Doppler information, temperature coverage and discrimination and, most important, very high spatial resolution to progress on the way to a fully comprehensive view of chromospheric and coronal heating.

Session 05: 11:20 – 13:00, Nov. 28, 2006

Observation of CME Source Regions by Coronal Emission-Line Dopplergrams

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Although observations with SOHO/LASCO show the behavior of CMEs beyond 2.5 solar radii, connection between LASCO CMEs and their source regions in the lower corona observed with SOHO/EIT or Yohkoh/SXT is not trivial. One way to fill the gap would be to supplement the Doppler shift information of the moving CME mass. Such an instrument was built and has been operated since 1997 July at the Norikura Solar Observatory (2876 m above sea level) of NAOJ. The instrument we call NOGIS (NOrikura Green-line Imaging System) is made of a 10 cm-aperture coronagraph and a tunable birefringent filter. NOGIS can provide both intensity and Doppler velocity images of 2 MK plasmas using the coronal green-line emission at 5303 Angstrom of Fe XIV. An intensity image is made by subtracting the sky background (taken at far wings) from the line-center image. A Doppler image is constructed by subtracting a blue-wing image from a red-wing image. The line-of-sight velocity up to 25 km/s can be obtained with an accuracy of about 0.6 km/s. NOGIS covers a field of view of 1.03 - 1.33 solar radii in a full frame mode, or a local small area in a partial frame mode with higher cadence of about 1 minute. So far we have analyzed two CME events which showed favorable orientations of the regions against the plane of the sky (1999 May 7 and 2003 June 2). In both events, interaction between two magnetic flux systems (loops in the case of 1999 May 7 and arcades in the case of 2003 June 2) was observed.

Magnetic Nature of Coronal Loops

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It is generally believed that magnetic pressure is much higher than the gas pressure in the coronal loops and these loops are isothermal in nature. We have made systematic observations of all the 4 strong coronal emission lines in the visible and near infrared part of the spectrum for about 8 years. Two emission lines were chosen at a time to make the raster scans of steady coronal region. We have studied the variation of line widths of these lines and intensity ratios as a function of height. The relationship between the widths of these lines and intensity ratio indicates that the steady coronal loops are not magnetically isolated. These findings put restrictions on coronal loops models and indicate that magnetic pressure in coronal loops may be much less than assumed. These results strongly suggest that magnetic field in the corona need to be measured accurately.

GMRT and Solar Radio Observations

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We, briefly describe the Giant Metrewave Radio Telescope (GMRT) which is one of the most sensitive radio instruments in the world, operating in the frequency range 150-1450 MHz. Although it is a high resolution aperture synthesis array for observing compact and extended galactic and extra galactic sources, we show that it is a very useful instrument for observing the Sun in the above frequency range. We have used it for observing flares, noise storms and coronal holes. In particular, we describe the recent GMRT 150 MHz observations of a coronal hole with a dynamic range of >20 dB. A comparison of the radio map with a resolution of about a minute of arc with the EUV data from SOHO/EIT and the corresponding SXR data from GOES SXI instruments shows that the total extension of the coronal hole is similar and the systematic shift in the position of the mid-points of the maps allows us to make an estimate of the average distance/height between the three emission regions, by assuming the shifts to be due to simple projection effects.

Variations in the Global Solar Radio Flux During the Extreme Solar Eruptions of October – November 2003

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We study the variations of the global solar radio flux obtained at 15400, 8800, 4995, 2995, 2800, 1415, 610 and 245 MHz during the extreme solar eruptions of October – November 2003. By least square fitting of above frequencies and the corresponding observed radio fluxes, the value of the spectral indices were derived assuming the variation of the radio flux with frequency of the form $S \sim f^{\alpha}$. The values of the spectral indices were less during periods of solar storms compared to quiet periods showing non-thermal contribution to the global radio flux. The value of the spectral index correlates negatively with the solar flare index.

Electron Acceleration in Solar Noise Storms

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We report high resolution, high dynamic range meter wavelength observations of noise storm sources in the solar corona. These observations were made by combining visibilities from the Giant Meterwave Radio Telescope (GMRT) in Pune, India, and the Nancay RadioHeliograph (NRH) in Nancay, France. These observations have the potential to place firm upper limits on the brightness temperature of noise storm sources. We have therefore carried out theoretical work on the energetics of non-thermal electron acceleration in noise storm sources. We have derived rigorous estimates for the overall efficiency of the overall noise storm emission process, beginning with non-thermal electron acceleration and culminating in the observed radiation.

Session 06: 14:00 – 15:40, Nov. 28, 2006

SOXS for IHY–2007 and Beyond

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We present on the utilization of existing mission namely Solar X-ray Spectrometer (SOXS) for observing the full disk Sun in the X-ray waveband in 4-56 keV. SOXS has been functioning satisfactorily since June 2003 though for a limited period of 2-3 hours daily. SOXS mission has so far observed more than 400 flares of varying intensity and a few of them are found to be associated with CMEs. We present recent results from SOXS observations that combined with optical and radio wavebands, which reveal loop-loop interaction as potential mechanism for those flares occurred with remote brightening. We also present study of microflares observed by SOXS mission and found that microflares are potential candidates for coronal heating. SOXS mission is expected to continue during ascending phase of solar cycle 24.

Sun-Earth Connection Studies at KASI

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We introduce our recent Sun-Earth connection studies which have been done in solar and space weather research group at KASI. In a series of papers, we have examined the physical characteristics of geoeffective halo CMEs that produced geomagnetic storms. First, we investigated the probability of geoeffective CMEs depending on its solar surface location and speed using SOHO/LASCO CMEs from 1997 to 2003. Second, we examined the relationship between several CME physical parameters (e.g., earthward direction, density, mass, location) and geomagnetic storms for very fast halo CMEs (VCME > 1300 km/s). In particular, we suggested a new earthward direction parameter that is defined as a ratio, the shorter front from the solar center to the longer one. Third, we examined the relationship between the field orientation in a CME source region and a geomagnetic storm using a coronal flux rope model as well as its dependence on ICME classification (magnetic cloud or ejecta). Major results are as follows. 1) The most probable areas whose geoeffectiveness fraction is larger than the mean probability (0.4), are 0<L<30 for slower speed CMEs (<800km/s), and 30<L<60 for faster CMEs (>800 km/s). 2) The CME direction has much better correlations with the Dst index than other parameters for very fast halo CMEs. 3) The relationship between the field orientation and the geomagnetic storm for magnetic cloud is much better than that for ejecta, implying that the field orientation of the magnetic clouds is well conserved through the heliosphere. We also briefly introduce several ongoing studies: (1) earthward direction as an important geoeffective parameter, (2) solar wind effect on the propagation of IP shocks, and (3) satellite drag effect during strong solar/geomagnetic activities and the comparison between the drag derived density and the MSIS-90 model. Finally, we present some future plans in the Sun-Earth connection field.

Propagation and Dissipation of MHD Waves in Coronal Holes

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In view of the landmark result on the solar wind outflow, starting between 5 Mm and 20 Mm above the photosphere in magnetic funnels, we investigate the propagation and dissipation of MHD waves in coronal holes. We underline the importance of Alfvén wave dissipation in the magnetic funnels through the viscous and resistive plasma. Our results show that Alfvén waves are one of the primary energy sources in the innermost part of coronal holes where the solar wind outflow starts. We also consider compressive viscosity and thermal conductivity to study the propagation and dissipation of long period slow longitudinal MHD waves in polar coronal holes. We discuss their likely role in the line profile narrowing, and in the energy budget for coronal holes and the solar wind. We compare the contribution of longitudinal MHD waves with high frequency Alfvén waves.

Observational Clues to the Origin of the Fast Solar Wind

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It is well known that the fast solar wind originates from coronal holes, but its source close to the solar 'surface' has been a matter of debate even in today's era of modern solar observations. Recently, it has been suggested that the fast solar wind outflow starts at about 10 kilometers per second in coronal funnels, which are located at the edges of the chromospheric magnetic network inside coronal holes.

We present further evidence that the outflow might also originate from above 'explosive event' sites. These jets have a lifetime of about 5 minutes and are often seen reoccurring at the same location over intervals of typically 20-30 minutes.

Although the expelled jets might actually extend high in the Sun's atmosphere, they are not seen in the intensity on the disk. Some of the transparent features might nevertheless appear as macrospicules at the Sun's edge. This observation itself is shedding new light onto another long-standing question regarding the nature of macrospicules.

These results about the small-scale structures of coronal holes and their consequence on explaining the nature of the fast solar wind have been derived due to an innovative way of extracting information from the spectral data offered by SOHO's highest resolution detector, SUMER. The 'secret' of our technique lies in understanding plasma properties from the signature it leaves in the shape and widths of the spectral lines.

Short Scale Magnetic Turbulence In The Solar Wind

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The solar wind is a great paradigm for investigating magnetohydrodynamic turbulence. It is shown that the frame work of Hall magnetohydrodynamics (HMHD), which can support three quadratic invariants and allows nonlinear states to depart fundamentally from the Alfvenic, is capable of reproducing in the inertial range the three branches of the observed solar wind magnetic fluctuation spectrum the Kolmogorov branch $k^{-5/3}$ steepening to k^{-α_1} with $\alpha_1 \approx$ 3-4 on the high frequency side and flattening to k^{-1} on the low frequency side. These fluctuations are found to be associated with the nonlinear Hall-MHD Shear Alfven waves.

Session 07: 16:00 – 17:00, Nov. 28, 2006

On the Slow-Rise Phase of Eruptive Quiescent Solar Prominences

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The observations taken in He 304 Å reveal that these images are extremely useful to trace prominences because of the relatively sharper spine which is better visible in 304 Å than in H-alpha. In this paper, we have studied several eruptive quiescent prominence images recorded by EIT in He 304 Å during January 2000 - July 2003 in an attempt to identify the precursors of CMEs that are associated with eruptive prominences. Our analyses show that erupting prominences evolve through a pre-eruptive phase and an eruptive phase which are characterized by lower velocities of several km/s and eruptive velocities of several tens to hundreds of km/s, respectively. The analyses also show that during the pre-eruptive phase, a prominence rises at a constant acceleration ranging between 4-12 cm/s^2 and not at constant velocity as reported by previous workers. The values of acceleration are found to be lower in comparison to that measured during the eruptive phase which ranges between 10-80 m/s^2. A comparison of height-time profiles of various features of prominences and associated CMEs provides information on their role in the eruption process. We suggest that the characteristic slow rise of eruptive prominences might be considered as reliable amongst all CME precursors. The kinematics of slowly rising filaments/prominences also helps in understanding the nature of propagation of the associated CMEs. We further investigated if the filaments which rise slowly are the ones which are associated with a slow expansion of the corona and/or slow outward motion before the phase of rapid mass expulsion. Such distinctions are extremely useful in identifying the eruption of CMEs directed toward the Earth, when they are associated with erupting filaments.

Coronal Mass Ejections in the Heliosphere

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Coronal mass ejections (CMEs) are the most energetic events in the heliosphere. They carry large amounts of coronal magnetic fields and plasma with them and driving large-scale interplanetary shocks. The CMEs and shock have significant consequences at various locations in the heliosphere, including the production of intense geomagnetic storms and large energetic particle events. CMEs form merged interaction regions in the heliosphere, which act as magnetic barriers for the galactic cosmic rays entering the heliosphere. After a brief summary of the observed properties of CMEs at the Sun, I discuss the properties of the interplanetary CMEs (ICMEs) and their connection to shocks, radio bursts, solar energetic particles and modulation of galactic cosmic rays.

Solar Wind Studies: Transients and Steady-State Flows

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This paper reviews the regular monitoring of the Interplanetary Scintillation (IPS) of a large number of radio sources at the Ooty Radio Telescope. These measurements provide images of the inner heliosphere and they are useful to study the conditions of the steady-state solar wind and the transients caused by the coronal mass ejections (CMEs) in the `Sun-Earth' space. The result indicates that the radial evolution of the CME speed is determined by its initial speed as well as by its interaction with the preceding transients/background solar wind. This study enables the empirical prediction of arrival of CME at 1 AU. The comparison of the observed and predicted arrivals enhances our understanding of the interaction between the CME and the ambient solar wind flow. The scintillation result on the steady-state solar wind and its changes with the solar cycle will also be discussed.

Session 08: 17:00 – 18:40, Nov. 28, 2006

Solar Energetic Particle Events and Geomagnetic Storms

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The solar energetic particle (SEP) events are the energetic outbursts as a result of acceleration and heating of solar plasma during solar flares and coronal mass ejections (CMEs). The SEP events are characterized by abrupt enhancements in the proton flux in the energy range of keVs to MeVs as measured by spacecraft at 1 AU. On impacting the earth's magnetosphere, the SEP events can lead to a sudden disturbance of the earth's magnetic field, known as Geomagnetic storms. In the present study, the effects of some strong SEP events of the present solar cycle on various magnetic storm processes are investigated by using the Solar flare and CME data from GOES-8 and SOHO, interplanetary plasma and magnetic field data from ACE and Wind, and the ground magnetic field data from Alibag and Tirunelveli magnetic observatories. The main focus will be to highlight the low latitude geomagnetic signatures produced by these SEP events. The SEP events with the persistence of high level of proton flux after the shock are found to be associated with intense magnetic storms. The role of SEP events in the prediction of intense geomagnetic storms will be discussed.

Solar Influence on Ionosphere and Radio Communications

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When we are discussing solar influence on Ionosphere, it will be helpful to remember that less than one-thousandth of the solar energy being intercepted by the planet Earth is responsible for its production and dynamics. This includes the solar wind energy intercepted by a much larger magnetosphere. But it is this small fraction of energy (in the X-rays, EUV and solar wind) that undergoes violent fluctuations during the course of a solar cycle and during such solar events as flares and Coronal Mass Ejections (CMEs).The consequences of these events are now generically dubbed as "Space Weather".

The problems created by extreme space weather events encompass a wide variety of applications of human interest. These include difficulties to satellite operations, ionosphere-reflected H.F Communications, GPS operations and even power grids and gas pipelines. I will restrict my presentation to H.F communications and to certain science elements such as anomalous plasma temperature variations measured by satellites. Particular attention will be given to increases in electron temperatures during magnetic storms in the night time when there is no photo-electron heat input. As this has a bearing on the present theory of electron thermal conduction associated with increase in neutral densities during storms, a detailed analysis will be presented using satellite data. Also the presentation will include examples of H.F communication failures especially at night time, contrary to what is expected at low latitudes. This has serious implications to the communication scenario in India in view of the high Atmospheric Radio Noise at the lower bands of the H.F. Spectrum.

Radar Studies of Ionospheric Plasma Irregularities

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High power high resolution VHF radars have proven to be powerful diagnostics to study ionospheric plasma irregularities, a space weather phenomenon of immense importance in view of its impact on space communication and navigation. The VHF radars at Jicamarca, Peru and Trivandrum, India have contributed greatly over the past four decades in arriving at the current understanding of the basic characteristics of the equatorial spread-F (ESF) and equatorial electrojet (EEJ) irregularities and the underlying plasma instability processes. Recent advances, involving high resolution radar observations of equatorial plasma irregularities, include the detection of supersonic plasma bubbles rising to heights beyond 1000 km, 150 km echoes and kilometric scale waves. The new and more recent developments in plasma irregularity studies came from the middle and upper atmosphere (MU) radar at Shigaraki, Japan and the mesosphere – stratosphere – troposphere (MST) radar at Gadanki, India. The new types of plasma irregularity structures observed by this mid- and low latitude VHF radars cover the well known quasi- periodic (QP) waves, tidal ion layers, kilometric scale waves and structures in the collision dominated lower E region. The paper presents an overview on the recent advances in the radar technique and the above mentioned new developments in observation and theory of the equatorial and low latitude ionospheric plasma irregularities.

Physical Processes underlying the Equatorial Effects of Solar Wind Dynamic Pressure (P_d) Variations

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In this talk, I shall endeavor to present a concise review of recent work concerning the equatorial geomagnetic and ionospheric effects of variations in solar wind dynamic pressure, P_d at the sub-solar magnetopause. Though the equatorial effects are the primary concern here, the global perspective will be retained to provide an overall picture of the coupling processes involving the magnetosphere-high latitude ionosphere-low latitude ionosphere domains. Two types of P_d changes are dealt with here. The first one is the sudden step-like increase in P_d representative of interplanetary shocks and other discontinuities in the solar wind that lead to the well-known geomagnetic storm sudden commencements (*SSC*) and sudden impulses (*SI*). These abrupt changes in P_d are documented to also initiate, at times, magnetospheric substorms and long-period (1hour) magnetospheric and ionospheric oscillations. Variation in P_d on time scales longer that of shocks and discontinuities are the other type. Awareness of the geomagnetic field response to this type of P_d changes is fairly recent and experimental evaluation of the physical situation that prevail at auroral and equatorial regions where the contribution of ionospheric currents may be expected to be as significant as those of magnetopause currents is indeed at a nascent stage now. In contrast, *SSC* and *SI* have been extensively studied over the decades using ground and space-borne magnetometers and a credible phenomenological model based on them has been developed, as also numerical modeling. Nonetheless, several fundamental and important questions remain to be settled. Foremost among these are: (1) the origin of the *bi-modal* response of the equatorial daytime H-field to sudden magnetospheric compressions induced by shocks with the resulting *SSC* taking two distinct forms, namely, with and without a preliminary reverse impulse (*PRI*) which occur more or less with equal frequency and (2) the mechanism of extension of the *PRI* from high latitudes to the dayside dip equator (propagation through the Earth-ionosphere waveguide or following the so-called *'Tamao path'?*). It is argued that to achieve progress in resolving these and other issues, in addition to the existing meridional magnetometer networks, the longitudinal network of equatorial magnetometers (run as a part of Circum-pan Pacific Magnetometer Network, CPMN by Kyushu University, Japan) needs to be strengthened as regards spatial coverage and GPS- time synchronization. New initiatives aimed at establishment of longitudinal networks of well chosen passive diagnostics of the ionosphere medium are also needed for the dip equatorial region. These requirements can be realized under the aegis of International collaborative and cooperative programs such as IHY.

Interplay Between the Equatorial Geophysical Processes

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With the sun as the main driving force, the Equatorial Ionosphere-thermosphere system supports a variety of Geophysical phenomena, essentially controlled by the neutral dynamical and electro dynamical processes that are peculiar to this region. All the neutral atmospheric parameters and the ionospheric parameters show a large variability like the diurnal, seasonal semi annual, annual, solar activity and those that are geomagnetic activity dependent. In addition, there is interplay between the ionized and the neutral atmospheric constituents. They manifest themselves as the Equatorial Electrojet (EEJ), Equatorial Ionization Anomaly (EIA), Equatorial Spread F (ESF), Equatorial Temperature and Wind Anomaly (ETWA). Recent studies have revealed that these phenomena, though apparently might show up as independent ones, are in reality interlinked. The interplay between these equatorial processes forms the theme for the present talk.

Session 09: 09:00 – 10:20, Nov. 29, 2006

Effect of Solar Variability on the Evolution of Equatorial Spread F

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Equatorial spread F (ESF) is a nighttime phenomenon of the equatorial and low latitude ionospheres. Its genesis is the growth of a generalized version of the Rayleigh-Taylor instability on the bottom-side of the equatorial F region. Ostensibly, conditions favorable for the growth of the instability are always present during post-sunset hours. However, the day-to-day variability in the occurrence and spatio-temporal characteristics of the electron density irregularities associated with ESF continues to elude explanation. Investigation of this phenomenon is of relevance from the practical point of view as well; since the intermediate scale length (~100m to a few km) irregularities associated with ESF, scatter incident radio waves of VHF or higher frequencies to produce fluctuations or scintillations in amplitude and phase of such radio signals recorded on the ground. Detrimental effects of ionospheric scintillations on satellite based communication and navigation systems such as GPS are particularly severe in the equatorial anomaly region. Solar variability has been observed to influence the ESF phenomenon. Effects of different aspects of solar variability on the evolution of ESF irregularities is explored here, on the basis of observations of ionospheric scintillations produced on radio wave signals by the intermediate scale ESF irregularities.

Long-Term Variabilities of Planetary-Scale Waves in the Mesosphere-Lower Thermosphere (MLT) Region

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The mesosphere-lower thermosphere (MLT) region is an important critical transition region that dynamically couples the middle atmosphere (20-100 km) with the upper atmosphere and ionosphere. This is the region where atmospheric gravity waves often achieve convectively unstable amplitudes and thereby dissipate, generate turbulence and deposit heat and momentum in the mean flow. Turbulence influences chemistry through the transport and distribution of long-lived chemical species such as NO. Tidal oscillations of 24-hour (diurnal) and 12-hour (semi-diurnal) periods are generated by water vapor and ozone insolation absorption in the troposphere and stratosphere and propagate through the mesopause into the lower thermosphere. Tides represent a major source of temperature and wind variability in the tropical mesopause region and are also capable of generating turbulence and depositing heat and momentum above 85 km. Other planetary-scale waves propagating through the mesosphere and contributing to its energy and momentum budgets are the global-scale normal modes, namely, the quasi-2-day and 16-day waves, the 6.5-day wave and the equatorially trapped wave mode, namely, the 3.5-day ultrafast Kelvin wave.

Through several collaborative studies making use of the existing MLT radar network, the IHY2007 programme would provide enough opportunities to examine how the above dynamical processes behave in longer time scales and influence the climate of the middle atmosphere. Long-term data sets on important planetary-scale wave parameters would also address the important issue of Sun/Earth connections induced by a possible planetary wave response to solar variability.

This talk is intended to motivate and promote such collaborative studies aimed to understand the processes responsible for the long-term variabilities of planetary-scale waves and their role in the climate of the middle atmosphere.

Radar and Lidar Probing of The Atmosphere

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Abstract yet to be received

A Tomographic Reconstruction Technique Applied to the GPS TEC Data

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An image of the dayside low-energy ion outflow event that occurred on 16 December 2003 was constructed with ground- and space-based GPS (Global Positioning System). Total Electron Content (TEC) data and ion drift meter data from the DMSP (Defense Metrological Satellite Program). A tomographic reconstruction technique has been applied to the GPS TEC data obtained from the GPS receiver on the Low Earth Orbit (LEO) satellite FedSat. The two dimensional tomographic image of the topside ionosphere and plasmasphere reveals a spectacular beam-like dayside ion outflow emanating from the cusp region. These outflows are associated with heating due to low-energy precipitating electrons. The transverse components of the magnetic field in the NewMag data show the presence of FAC (field aligned current) sheets, indicating the existence of low energy electron precipitation in the cusp region. The DMSP ion drift data show upward ion drift velocities and upward fluxes of low energy ions and electrons at the orbiting height of the DMSP spacecraft in the cusp region. This study presents the first image of the flux tube structure of ionospheric ion outflows from 0.13 Re up to 3.17 Re altitude.

Session 10: 10:40 – 12:10, Nov. 29, 2006

Generalized Measure of Entropy, Mathai's Distributional Pathway Model, and Tsallis Statistics

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The well-known pathway model of Mathai (2005) mainly deals with the rectangular matrix-variate case. In this paper the scalar version is shown to be associated with a large number of probability models used in physics. Different families of densities are discussed, which are all connected through the pathway parameter α, generating a distributional pathway. The idea is to switch from one functional form to another through this parameter and it is shown that basically one can proceed from the generalized type-1 beta family to generalized type-2 beta family to generalized gamma family when the real variable is positive and a wider set of families when the variable can take negative values also. For simplicity, only the real scalar case is discussed here but corresponding families are available when the variable is in the complex domain. A large number of densities used in physics are shown to be special cases of or associated with the pathway model, including Maxwell-Boltzmann, Fermi-Dirac, and Bose- Einstein distributions. It is also shown that the pathway model is available by maximizing a generalized measure of entropy, leading to an entropic pathway. Particular cases of the pathway model are shown to cover Tsallis statistics (Tsallis, 1988) and the superstatistics introduced by Beck and Cohen (2003).

Test of Non-extensive Statistical Mechanics by the Solar Sound Speeds Measured in Helioseismology

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To check the validity of the theory of non-extensive statistical mechanics, we have investigated the non-extensive degree of the solar interior and have tried to find the experimental evidence by helio-seismological measurements that q is different from unity. We are able to derive a parameter for providing a lower limit to the non-extensive degree inside the sun that can be uniquely determined by the solar sound speeds measured by helioseismology. After calculating the parameter by using the solar sound speeds, we get the lower limit of $(1-q) \geq 0.1902$ for all solar radii between $0.15R_\odot$ and $0.95R_\odot$ and $(1-q) \approx 0.4$ for the out layers, $0.75R_\odot \leq r \leq 0.95R_\odot$. Thus, the result that the non-extensive parameter q is significantly different from unity in the sun has received the support by the experiment measurements for the solar sound speeds in helioseismology.

Systematics of Dynamo Action in a Shell Model for Magnetohydrodynamic Turbulence

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We carry out high-resolution studies of the dynamo effect in a shell model for magnetohydrodynamic (MHD) turbulence at low magnetic Prandtl numbers (as low as 10^5). We present the stability diagram for the formation of a turbulent dynamo in this MHD shell model in magnetic Prandtl number and magnetic Reynolds number plane. Our systematic numerical studies show that a fractal-like boundary separates the dynamo and no dynamo regimes in this plane.

Session 11: 12:10 – 13:10, Nov. 29, 2006

CALLISTO – Radio Spectrometer

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CALLISTO, a low cost radio spectrometer, will be distributed all over the world at different longitudes for continuous observation of the solar-radio activity at meter- and decimeter wavelengths. All data will be collected at ETH Zurich via the Internet to produce a 24th overview between 45MHz and 870MHz. All participants will have full access to all data captured within this project. The concept and technical detail of CALLISTO and hopefully some first results will be presented. A full operational spectrometer will also be presented during the meetings.

Chain-Project and Installation of Flare Monitoring Telescopes in Developing Countries

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The Flare Monitoring Telescope (FMT) was constructed in 1992 at the Hida Observatory in Japan to investigate the long-term variation of solar activity and explosive events. It has been part of the international coordinated observations program (STEP) since 1991. The FMT consists of five solar imaging telescopes and one guidescope. The five telescopes simultaneously observe the full-disk Sun at different wavelengths around H-alpha absorption line or in different modes. Therefore, the FMT can measure the vector velocity field of moving structures on the full solar disk without the visual effect. We want to monitor solar flares and erupting filaments continuously as much as possible by using several of such characteristic telescopes. We are then planning to execute the "Continuous H-alpha Imaging Network (CHAIN)-project". As part of this project, we are examining the possibility of installing the telescopes in developing countries with acquiring the necessary funds from the United Nations. More precisely, we are currently examining Peru as a candidate country where a telescope will be installed. Moreover, there are a lot of items that should be investigated in various respects in advance, such as the natural environment, the human environment and the method of clerical work procedure, etc. In this talk, we introduce characteristics of the FMT, some scientific results and our plans of installing the FMT in Peru.

Space Weather Activities at SERC for IHY : Magnetic Data Acquisition System (MAGDAS)

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One purpose of Solar Terrestrial Physics (STP) research in the twenty-first century is to support human activities in Space from the aspect of basic research. The scientific aim of the STP community is the creation of new physics: (1) couplings of the complex and composite systems and (2) macro-and-micro-scale couplings in the Solar-Planetary system. The intention is to construct a new Network of Stations for ground-based observations and for simulations/empirical modeling.

The Space Environment Research Center (SERC), Kyushu University, is currently deploying a new ground-based magnetometer network, in cooperation with about 30 organizations around the world, in order to study the complex Sun-Earth system for space weather. SERC conducts MAGDAS (MAGnetic Data Acquisition System) observation at 50 stations in the CPMN (Circum-pan Pacific Magnetometer Network) region, and conducts frequency modulated continuous wave (FM-CW) radar observation along the 210° magnetic meridian during the IHY/IPY/eGY/ ILWS/CAWSES periods. From these network observations, we will clarify:

(1) The dynamics of plasmaspheric changes during space storms and substorms,

(2) Electromagnetic responses of magnetosphere-ionosphere-thermosphere complex system to various solar wind changes, and (3) penetration mechanisms of DP2-ULF range disturbances from the solar wind into the equatorial ionosphere.

In the present paper, we will first introduce our real-time data acquisition and analysis system of MAGDAS/CPMN, which was deployed in 2005 and 2006, and preliminary results from the MAGDAS project. This project is actively providing the following:

(1) Monitoring the global 3-dimensional current system to know the electromagnetic coupling of high-latitude and Sq current systems, and

(2) Monitoring of the plasma density to understand space plasma environment change during space storms. We will also present our FM-CW radar system at L=1.26 to deduce the electric field from the ionospheric plasma drift velocity. From 24hr monitoring of the ionospheric drift velocity with 10-sec sampling by the FM-CW radar observation, we can understand how the polar electric field penetrates into the equatorial ionosphere.

Session 12: 14:10 – 15:30, Nov. 29, 2006

Geophysics Integrated Studies in the Sun Earth System: A Cooperative Project of Vietnam, Europe, and Africa

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The Hanoi Institute of Geophysics (Vietnam) will participate to international Heliophysical Year. This paper presents Vietnam's participation into this International cooperative project : the Vietnamese network of magnetometers, meteorological stations, ionosondes and GPS receivers involved in campaigns of measurements, the research field selected for the training of young Vietnamese scientists, and the Institutes involve in this training. This paper also presents some particularities of geophysical parameters in Vietnam : the strong amplitude of the equatorial electrojet observed by satellite data and confirmed by magnetic observations at the ground level presented for the first time to the international community, the monsoon signature etc. Finally the differences between the Asian sector and the African sector lead to the development of comparative studies between Asia and Africa.

Expanding the SCINDA Sensor Network for the IHY- 2007

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The first communications satellites were launched in the early 1960s to support the needs of a small and specialized user community. Since that time the number of systems has expanded dramatically so that a majority of the world's population now benefits from the communication and navigation services available. As the use of space-based RF systems has increased, the impacts of ionospheric disturbances have become more significant. The most serious effect of these disturbances is known as scintillation, a phenomenon caused by small-scale variations in electron density (irregularities) along the propagation path that result, principally through diffraction, in rapid amplitude and phase fluctuations of the radio wave. Substantial mid- latitude disturbances are generally associated with infrequent magnetic storm events, but significant irregularities form routinely at both high and low latitudes. At equatorial latitudes, the occurrence of post-sunset Spread F is of special concern because the region affected comprises more than 30% of the earth's surface and the effects on VHF and UHF radio wave propagation are severe. To better characterize this phenomenon and now cast its occurrence, the Air Force Research Laboratory (AFRL) has developed a ground-based sensor system to autonomously monitor scintillation using available satellite beacons such as geostationary satellite communication signals and GPS. Known as the Scintillation Network Decision Aid (SCINDA), the system performs real-time on-site calculations of scintillation parameters, zonal drift velocity and total electron content (TEC) and retrieves the data from low-latitude stations via the internet at regular intervals. Fourteen sites have been established thus far and the network is expected to double over the next two years with expansion across Africa and Asia. The African sector is of special interest because very limited historical ground-based observations exist while recent satellite data suggest global activity may actually peak over the continent. The goal is to establish new monitoring sites in time to support the International Heliophysical Year (IHY) 2007 and maintain the sensors operation through the next solar maximum in 2011-12.

Preliminary Observations of Ionospheric Structures using Ground Receivers and the COSMIC Radio Beacon

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With the launch of the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) satellite constellation, a new era has begun for low-Earth-orbiting (LEO) satellite beacon research has begun. Each COSMIC satellite carries a radio beacon that can emit at 1066, 400, and 150 MHz. Coherent Ionospheric Doppler Receivers (CIDR) deployed at mid-latitudes observe the electron content and phase scintillation in the 400 and 150 MHz channels. In addition to high (Alaska and Greenland) and low (Peru) latitude systems, CIDRs are deployed in Austin, Texas, a chain across southern New York, Millstone Hill, and Wallops Island. This study presents preliminary observations of different ionospheric structures using CIDR receivers and the COSMIC radio beacon.

VLF Remote -Sensing of the Lower Ionosphere with AWESOME Receivers: Solar Flares, Lightning-induced Electron Precipitation, Sudden Ionospheric Disturbances, Sprites, Gravity Waves and Gamma-ray Flares

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Stanford University Very Low Frequency (VLF) radio receivers have been used extensively for remote sensing of the ionosphere and the magnetosphere. Among the phenomena that can be uniquely measured via VLF receivers are radio atmospherics, whistlers, electron precipitation, solar flares, sudden ionospheric disturbances, gravity waves, sprites, and cosmic gamma-ray flares. With the use of simple square air-core magnetic loop antennas of a couple of meters in size, the sensitivity of these instruments allows the measurement of magnetic fields as low as several tens of femtoTesla per root Hz, in the frequency range of ~300 Hz to 50 kHz. This sensitivity well exceeds that required to detect any event above the ambient atmospheric noise floor, determined by the totality of lightning activity on this planet. In recent years, as cost of production, timing accuracy (due to low cost GPS cards), and data handling flexibility of the systems has improved, it has become possible to distribute many of these instruments in the form of arrays, to perform interferometric and holographic imaging of the lower ionosphere. These goals can be achieved using the newest version of the Stanford VLF receiver, known as AWESOME: Atmospheric Weather Educational System for Observation and Modeling of Electromagnetics. In the context of the IHY/UNBSS program for 2007, the AWESOME receivers can be used extensively as part of the United Nations initiative to place scientific instruments in developing countries. Drawing on the Stanford experiences from setting up arrays of VLF receivers, including an interferometer in Alaska, the Holographic Array for Ionospheric and Lightning research (HAIL) consisting of instruments at 13 different high schools in mid-western United States, a broader set of ELF/VLF receivers in Alaska, and various receivers abroad, including in France, Japan, Greece, Turkey, and India, a global network of ELF/VLF receivers offer possibilities for a wide range of scientific topics, as well as serving as a means for educational outreach. Most recently, AWESOME receivers were placed in several North African countries, including Tunisia, Algeria, and Morocco. The new AWESOME version is substantially lower in cost, and easier to set-up and use. Nevertheless, the receivers offer the same ultimate levels of resolution in time, sensitivity and dynamic range, as well as ease of handling of data that is used by researchers conducting cutting edge ionospheric and Space Weather research. In this context, the placement of these systems at underdeveloped host countries provides an open-ended potential for exploration, limited only by the imagination and drive of the users.

Session 13: 16:00 – 17:00, Nov. 29, 2006

Southern Hemisphere Magnetic Variations Improved Coverage and South Atlantic Magnetic Anomaly (SAMA) Monitoring by the Installation of a Small Magnetometer Network on the Brazilian Territory

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At the present time the magnetic planetary indices, specially the K_p (A_p) index, are basically North Hemisphere indices since the ample majority of the magnetic observatories that generate the indices are located above the Equator.The improving necessity in the coverage of the planetary indices leads to the installation of new and modern equipment in the Southern Hemisphere. Brazil has a special location in terms of being the site for the installation of such equipment. The South Atlantic Magnetic Anomaly (SAMA) is over the South Brazilian region at this moment and there are several groups from research institutes and universities, in Brazil, that can operate and maintain the equipments, carry out the data analysis and put the available data on the Internet.

Space weather is a modern term to denote physical conditions in space around the Earth that are ultimately determined by solar activity. Space weather manifests itself through various physical phenomena such as enhanced intensity of hard radiation, increased strength of electric and magnetic fields and elevated magnitude of electric currents, to name only a few. A "magnetic storm", which may also be called a "space storm", is a rather violent phase of space weather and is often caused by solar outbursts such as flares and coronal mass ejections. Solar outbursts create disturbances of the solar wind that may impact the Earth environment with a delay of a few days after their eruption from the Sun.

Also at the present time the Kp world network is composed of 13 magnetic observatories, 11 northern and two southern stations. The K indices are defined everywhere, but are most significant at sub-auroral latitudes. In the proposed project several magnetometers in the network could contribute to the generation of the planetary average giving a more realistic character to the index.

Main scientific goals:

- Improvement in the monitoring of the Southern Hemisphere magnetic variations
- Local and continuous monitoring of the South Atlantic Magnetic Anomaly (SAMA)
- Magnetosphere/atmosphere interaction
- Equilibrium mechanisms of the Van Allen Radiation Belts (Trimpi events versus geomagnetic activity)

In this presentation we will defend the implementation of a small network of magnetometers on the Brazilian territory (Figure 1) and we will show some important benefits that it could bring to the current space physics research, specially having in mind the implementation of the IHY-2007.

High Latitude Energetic Particle Boundaries: The SAMPEX Database

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The size of the polar cap or the open field line region depends, upon the difference in reconnection rates at the dayside between the IMF and the geomagnetic field, and those occurring in the magnetotail. The dayside merging adds flux to the open field region increasing the polar cap size and the magnetic flux in the lobes of the tail, thereby causing energy to be stored in the magnetosphere. Night side reconnection, geomagnetic storms and substorms dissipate this energy removing flux and shrink the polar cap. The dynamics of the polar cap can therefore be useful in the study of the energy dynamics of the magnetosphere.

Energetic particles delineate magnetospheric regions, since their motions are governed by the geomagnetic field. Convection and corotation electric fields control the drift of low energy particles whereas magnetic field gradient and curvature are the dominant factors for higher energy (> ~30 keV) particles. High latitude energetic particle boundaries are related to the polar cap and therefore useful in determining the size of the open field line regions

We will provide a long database of energetic particle boundaries in the polar regions using instruments aboard SAMPEX, the first of the Small explorer (SMEX) spacecraft. It was launched on July 3, 1992 into a low earth polar orbit. There are four particle detectors, HILT, LICA, PET and MAST on board which point toward the zenith over the poles of the Earth. These detectors measure electrons, protons and ions ranging in energy from tens of keV to a few MeV.

This database will comprise the latitudinal (geographic, magnetic and invariant) and longitudinal (geographic and magnetic local time) positions of energetic particle boundaries in the polar regions. The database will cover a time period from launch to about mid 2004. It will therefore cover a significant portion of the solar cycles 22 and 23.

Together with interplanetary data obtainable from public databases, such as the NASA OMNI database the SAMPEX energetic particle database can be used to relate Earth's magnetospheric response to the interplanetary drivers such as solar wind speed, density and magnetic field.

Prospects for GDL and SSW

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We demonstrate that great progress has been made in developing GDL as an alternative for using Solar Software IDL programs. We shall give an up to date status on the prospects for using this free software as an alternative for the more costly RSI/IDL.

Session 14: 09:00 – 10:40, Nov. 30, 2006

Coordinated Investigation Program: IPS and Callisto at Ooty

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In this presentation, the concept of Coordinated Investigation Programs (CIP) will be introduced and some examples presented. The interplanetary scintillation (IPS) measurements available from different observatories through CIP during 2007-2008 and for the later period will be discussed. The operation of the Callisto, the solar radio spectrograph hosted at the Radio Astronomy Centre, will be discussed with some examples.

Very Low Frequency (VLF) studies of Ionospheric/Magnetospheric Electromagnetic phenomena in Indian Low Latitude Region using AWESOME Receivers

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Ground based observations of whistler mode ELF/VLF (300 Hz 30 kHz) waves are considered as an important remote sensing tool for the investigation of upper atmosphere and magnetosphere. These VLF waves find their origin in various natural and artificial phenomena, the natural sources include thunderstorms, lightning and associated phenomena. Despite of the fact that conjugate region of India having less lightning activity as it lies in Indian Ocean and also the height of the magnetic field lines connecting the conjugate regions lies in the ionosphere/atmosphere, lot of interesting VLF activity through the magnetosphere is observed in Indian low latitude region. Sub-ionospheric VLF transmissions propagating inside the Earth-ionosphere wave-guide is also being widely used for investigating sudden ionospheric perturbations in lower part of the ionosphere. For this purpose we propose to monitor VLF signals continuously at several locations in Indian sector with the help of AWESOME VLF receivers from Stanford University. AWESOME receivers are capable of collecting both broadband (used for the study of natural signals) and narrowband (sub-ionospheric VLF signals corresponding to VLF transmitters) data. The obtained data will enable us to understand the generation and propagation mechanism of radio atmospherics from lightning flashes, magnetospheric whistlers, VLF emissions and other naturally occurring phenomena. Narrowband sub-ionospheric VLF signals and ground based geomagnetic data in Indian low latitude region will help us to study sudden ionospheric disturbances associated with transient phenomena like solar flares, geomagnetic storms, cosmic gamma-ray flares, etc.

Space Environmental Viewing and Analysis Network (SEVAN) - A Network of Neutron Monitors in Bulgaria

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A network of middle to low latitude particle detectors called SEVAN (Space Environmental Viewing and Analysis Network) aims to improve fundamental research of the space weather conditions and provide possibilities to perform short and long-term forecasts of the dangerous consequences of the space storms. The network will detect changing fluxes of the most species of secondary cosmic rays at different altitudes and latitudes, thus constituting powerful integrated device in exploring solar modulation effects. Recently two more countries have decided to host cosmic ray monitors - Bulgaria and Croatia.

Preparation of IHY-2007 in Indonesia: Local Observational Facilities, International Collaborations, and the Use of International Data

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Since 1980, the National Institute of Aeronautics and Space (LAPAN) has been carrying out integrated observations of solar activities, geomagnetic disturbance, and ionospheric parameters, as well as other solar-terrestrial relationship research. International collaboration, especially with Japan in the field of solar physics, geomagnetism and equatorial atmosphere and with Australia in the field of ionosphere and upper atmosphere, help us in increasing national capacity building. The international data available on the Internet also helps us in comparing our local data with the global one or in fulfilling our needs of data due to lack of facilities, ground based or space based data. Some results will be reviewed. Preparation for IHY-2007 will also be discussed.

Space and Atmospheric Physics Education and Research at North Carolina A&T State University

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In this communication we discuss the new undergraduate and graduate space and atmospheric physics program at NC A&T State University. The program is designed to train future generation space scientists to meet the workforce needs of NASA, aerospace industries and academic institutions. In order to fortify this effort, we have initiated collaboration with US Air Force, GSFC and University of Michigan. We plan to contribute to the current scientific issues associated with TEC variations, scintillations and disturbances, and the morphology/manifestations of Ionospheric Spread F phenomena, and their variations with locations, specifically over low and mid-latitudes. In order to facilitate research we plan to install a magnetometer, a coherent beacon receiver and GPS receivers. In the long run the space science research community and K12 students and teachers will use of these facilities. We will discuss our recent experience during the IHY-SCINDA 2006 workshop, in Sal Cape Verde, as well as the plans of the upcoming IHY-Africa workshop, November 5-9, 2007 Addis Ababa Ethiopia.

Session 15: 11:00 – 12:45, Nov. 30, 2006

Astronomy in Syria

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Syria has been involved in the field of astronomy since 1997, when Prof. F.R. QUERCI, France, visited Syria and made a presentation on the International NORT project; (NORT: the Network of Oriental Robotic Telescope), which was a selected project of the sixth United Nations/ European Space Agency Workshop on Basic Space Science (document no. A/AC.105/657 dated 13/12/1996). NORT aims to establish a robotic telescope network on high mountain peaks around the Tropic of Cancer, from Morocco in the west to the desert of China in the east. The purposes for establishing this network are technical and educational. The General Organization of Remote Sensing (GORS) has carried out a pilot study using remote sensing techniques and has selected four sites in order to determine the best location for the astronomical observatory the within NORT programme. Following this project, GORS decided to establish an office for astronomical studies, one of the earliest works of GORS in astronomy was an initiative to establish a planetarium within the GORS campus, to accommodate approximately 120 observers. A contest to choose the best planetarium design, for the Arab World, took place at GORS.

A Solar Station for Education and Research on Solar Activity at a National University in Peru

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Beginning in 1937, the Carnegie Institution of Washington made active regional observations with a spectro-helioscope at the Huancayo Observatory. In 1957, during the celebration of the International Geophysical Year Mutsumi Ishitsuka arrived at the Geophysical Institute of Peru and restarted solar observations from the Huancayo Observatory. Almost 69 years have passed and many contributions for the geophysical and solar sciences have been made. Now the Instituto Geofisico del Peru (IGP), in cooperation with the Faculty of Sciences of the Universidad Nacional San Luis Gonzaga de Ica (UNICA), and with the support of the National Astronomical Observatory of Japan, are planning to construct a solar station refurbishing a coelostat that worked for many years at the Huancayo Observatory. A 15 cm refractor telescope is already installed at the university, for the observation of sunspots. A solar Flare Monitor Telescope (FMT) from Hida Observatory of Kyoto University could be sent to Peru and installed at the solar station at UNICA. As the refurbished coelostat, FMT will become a good tool to improve education and research in sciences.

Radiative Transfer Model in the Atmosphere and Experimental Solar Data of Yaounde Location

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The Sun is the primary source of energy supplying the Earth. This energy absorbed by the various components of the atmosphere, the oceans, the vegetation and Earth's surface, is at the origin of the forces that control the climatic changes, the general circulation of the atmosphere, the temperature of the atmosphere and that of the oceans and the ionization of atmospheric gases, etc. The solar energy received on Earth's surface is also directly used in technological applications such as solar heaters, solar dryers and other solar distillers, and the photovoltaic generators, etc. The calculation of the thermal performances of these apparatuses can be well made only if the spectral and even angular distribution of the solar irradiation arriving on the ground surface is well known. Moreover, the well known characteristics of the solar radiation arriving on the ground could inform us about the atmospheric phenomena that influenced its transfer, and consequently provide a better correction of the sensors response while receiving a signal from outer space in its direction, or the correction to be made on the response of a sensor while receiving data from a terrestrial sender.

Only a few measurement stations of solar radiation are currently running and are not well managed, particularly in developing countries where the maintenance of a park of pyranometers on the ground is difficult and expensive. Moreover, where these measurements exist, they are rarely carried out for various wavelengths and/or angles.

Such data are on the other hand accessible by numerical calculation, by solving the radiative transfer equation (ETR) in the atmosphere. One of the major factors attenuating the solar radiation received on the ground is scattering by clouds. The non- homogeneous nature of the clouds justifies the difficulty shown by the researchers to insert realistic profiles of clouds in radiative transfer models in a parallel stratified atmosphere [1, 2]. Several recent studies showed that this non-homogeneity has significant impacts on the transmitted radiation, calculated either for the thick and continuous clouds [3] or for dispersed clouds [4, 5]. Such structures must be studied with a multidimensional radiative transfer model, as for example the one of Stephens [6] judiciously exploited recently by Evans [7], which breaks up the angular part of brightness into spherical harmonics while the space part is simply discretizised by finite differences. We intend here to make a comparison between results of this model and the experimental data collected in Yaounde [8-13]. This is in order to detect its forces, weaknesses and the possible improvements that could be done to guarantee a prediction free from any significant variation with reality.

The first part is devoted to the description of the model. In the second part, we present the results of the model as well as the values resulting from experimental measurements. The last part discusses these results.

High Resolution Spectral Analysis for Irregularly Sampled Helioseismic Data

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Astronomical ground based data are very often irregularly sampled due to many factors such as: diurnal effect, weather conditions, etc. The analysis of such data cannot be performed with classical tools (such as periodigram) and new adapted methods are required. After presenting some of these techniques, we will focus on a regularized approach of the spectral analysis problem, which gives very good results in the case of band limited and narrow peaks spectrum. We will also show that with this approach we can achieve high-resolution spectra. Indeed, in classical Fourier analysis, spectral resolution is inversely proportional to the observation time T. Considering the spectral analysis problem as an inverse problem and introducing the "a priori" knowledge of band limited and narrow peak spectrum, this limit (1/T) can be exceeded and thus we can achieve highly resolved spectra, even with irregularly sampled data. This technique will be first applied to relevant simulated data, then to helioseismic data.

Additional talk: "Brief description of solar projects in Algiers Observatory"

A brief description of all projects developed in our department and that are related to the sun: helioseismology, solar data analysis (pipelines description), solar activity, VLF project, solar astrolabe (for solar diameter measurement), site testing for day-time observations, and the project of solar observatory in the Tamanrasset area.

Indication of Solar Signal in Indian Ocean Dipole (IOD) Phenomena over Indonesia

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It has been proposed before that dipole mode phenomena, can cause climate variability in the tropical Indian Ocean region. From empirical evidence, it also has been suggested that solar activity plays a role in affecting climate globally as well as regionally. Here, we support these opinions by reporting that the IOD, in general, has a good correlation with cloud cover especially for western Indonesia (with the Monsoon's climate pattern) from April 1976 to January 1996, which is indicated by correlation coefficient r=0.64. By using wavelet analysis we also find that solar signals appear strongly on IOD over the December-February period (or wet season in the Monsoon's climate pattern).

A Developed Numerical Mapping Technique

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An automated mapping technique for representing the hourly behavior of the ionosphere was presented by Rush in 1976. The technique is based on updating the predicted monthly median maps of ionospheric parameters with hourly observations. The procedure was accomplished by computing the differences between the predicted medians and the hourly values of ionospheric parameters that are observed at specific locations on the globe. This technique provides the basis for extending and extrapolating the influence of an observation from the observing location to the region surrounding the observing location. This method is very complicated, so in our research we used another newly developed method. The designed and implemented program in our work for a new mapping technique method was suggested and used to draw the maps based on updating the monthly median of ionospheric parameters predicted with geographic coordinates.

Determination of the Coefficient of Correlation Between Radiation and Relative Humidity, and Determining Equation of the Line of Best Fit Using Statistical Methods

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This paper investigates the inter-relationship between solar radiation intensity RD and relative humidity RH in Kenya using daily data obtained at five meteorological stations; Nairobi (1.3°S, 36.75°E), Kericho (0.37˚S, 35.72˚E), Kisumu (0.10˚S, 34.75˚E), Mombasa (4.03˚S, 39.65˚E) and Garissa (0.48˚S, 39.63˚E) during the solar minimum year 1986. Statistical methods were employed and the coefficients of correlation, r obtained range from –0.16094 to -0.6758618 between the two variables for the five stations. The linear equation relating the solar radiation intensity RD to relative humidity RH is obtained using linear regression analysis as RH = 109.1091-1.5997RD for the Nairobi station. Jandel scientific and Megastat software analyses gave fairly similar trends of results for Nairobi and other stations, and for all the seasons except for those of Garissa station. Obviously there exists a negative interdependence between solar radiation intensity and relative humidity such that the relative humidity decreases as solar radiation increases and vice versa. This observation is explicable in terms of the dynamics of atmospheric heating and advection traceable to solar activity.

Session 16: 14:00 – 15:30, Nov. 30, 2006

The Gap in Global Ionospheric and Heliospheric Measurements over Africa: Our Proposals for IHY-2007

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One of the main goals of IHY is to promote space science activities in developing countries. We summarize the current status and perspectives of ionospheric and heliospheric projects in several African countries. The study concerns the GPS receivers, ionosondes, magnetometers and their contribution to the global worldwide measurements. A case study of some energetic events shows the necessity of establishing central stations in Africa to cover the data break in this region of the world. Finally, we discuss the proposals and challenges of IHY 2007 in both educational and space science research, as well as, the framework of the future strategy for the development of space science in Africa.

Space Sciences Education and Outreach Project of Moscow State University

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The space sciences education and outreach project was initiated at Moscow State University in order to incorporate modern space research into the curriculum popularize the basics of space physics, and enhance public interest in space exploration. On 20 January 2005 the first Russian University Satellite "Universitetskiy-Tatyana" was launched into circular polar orbit (inclination 83 deg., altitude 940-980 km). The onboard scientific complex "Tatyana", as well as the mission control and information receiving centre, was designed and developed at Moscow State University. The scientific programme of the mission includes measurements of space radiation in different energy channels and Earth UV luminosity and lightning.

The current education programme consists of basic multimedia lectures "Life of the Earth in the Solar Atmosphere" and computerized practice exercises "Space Practice" (based on the quasi-real-time data obtained from "Universitetskiy-Tatyana" satellite and other Internet resources). A multimedia lectures LIFE OF EARTH IN THE SOLAR ATMOSPHERE containing the basic information and demonstrations of heliophysics (including Sun structure and solar activity, heliosphere and geophysics, solar-terrestrial connections and solar influence on the Earth's life) was created for upper high-school and junior university students. For the upper-university students there a dozen special computerized hands-on exercises were created based on the experimental quasi-real-time data obtained from our satellites. Students specializing in space physics from a few Russian universities are involved in scientific work. Educational materials focus on upper high school, middle university and special level for space physics students. Moscow State University is now extending its space science education programme by creating multimedia lectures on remote sensing, space factors and materials study, satellite design and development, etc.

The space sciences educational activity of Moscow State University is a non-profit project and is open for all interested parties. "Space schools" for university teachers and students were held in the autumn of 2004 and 2005. The main objective of those schools was to attract interest in space research. Tutors and students who took part in these schools had never before been involved in the space sciences. The idea behind these schools was to join forces: Moscow State University scientists gave space science lectures, students from different universities (Ulianovsk, Samara, Kostroma and other Russian universities) performed the work (prepared educational material) and their university teachers managed the students. After participating in these schools, both students and teachers started to study space science related topics emphasizing the success of these schools.

It is important for the educational community to understand what skills future space scientists and space industry employees must be equipped with. In the next years, emphasis is to be placed on space science education at all educational levels and better communication should be practiced between universities and industry.

Optimal Long Binary Phase Code-Mismatched Filter Pairs with the Application to Ionospheric Radars

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Binary phase codes have been often used in radar systems. The most widely known binary phase codes are Barker codes. Families of binary phase codes, which are called alternating codes, have been also discovered]. In a radar system, which employs a binary phase code, a matched filter is usually used to obtain a very high range resolution without decreasing the average transmitted power. However, matched filtering of a binary phase code gives unwanted sidelobes at the filter output. The amplitude of the sidelobes depends on the phase patterns of the binary phase code. Significant research effort has gone to search binary phase patterns that give smallest possible sidelobes. Most often peak-to-sidelobe ratio (PSR), integrated sidelobe ratio (TSR) and merit factor (F) are used as criterions to search for the best binary phase codes. The Barker codes have relatively high PSR. Other kind of binary phases with improved PSR have been found, including the 28-element code by Turyn] and the 40-element code by Lindner]. Although binary phase codes with maximum PSR can be satisfactory for some applications, in some cases removing the sidelobes reveals new and important information. Key showed that weighting networks to be placed after the standard matched filter can be designed, which reduces the sidelobes to an arbitrary low level. For any periodic digital signal with linearly independent cyclical shifts, lpatov] has showed that a filter can be constructed that suppresses to a zero level all the sidelobes. However, the filter has associated SNR losses when compared to the corresponding matched filter. Lpatov carried out a computer search for a binary periodic signal-filter pair with minimum possible SNR losses. The search includes all binary codes of length up to 30 elements. A different approach for eliminating the sidelobes in periodical binary phase codes by using mismatched filter have been published by Rohling and Plagg]. Exhaustive search for optimal aperiodic binary phase codes and mismatched filter pairs up to length of 25 has been carried out by Lehtinen. The benefits of eliminating sidelobes are also demonstrated in using real radar measurements. In this paper we present mismatched filtering of aperiodic binary phase codes. This is done without creating any sidelobes. A mismatched filter has small losses in SNR when compared with the corresponding matched filter. We have selected the best binary phase codes with length from 26 to 39. The best codes are the ones which have the smallest SNR losses in mismatched filtering when compared with the corresponding matched filtering. We have chosen one best code from each length and this means we have selected 14 different length best binary phase codes. These codes were chosen from a total number of 5.4972 x 1011 investigated codes. We have found these codes have nearly similar losses in SNR and it is about 15 percent. We did not find a binary phase code that outperforms the well-known 13-element Barker code, which has 4.8 percent SYR losses .

Influence of Solar Energetic Phenomena on GPS PWV During the Major Storm of 2003 at Scott Base Station, Antarctica

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The influence of solar energetic phenomena, solar flare index and extreme ultraviolet (EUV) on precipitable water vapor (PWV) are investigated during the intense 2003 geomagnetic storms at Scott Base station Antarctica for the period between 22 October and 7 November 2003. The PWV parameter is obtained from the GPS signals and surface meteorological data (pressure, temperature and humidity) measured at the site, while the solar flare index (SFI) and Solar EUV are obtained from Kandilli Observatory, Turkey and SOLAR2000 Space Environment Technologies, USA, respectively. The geomagnetic data during the storm are obtained from the World Data Center for Geomagnetism (WDC-C2), Kyoto and NOAA SEC, USA. Analysis of result showed that PWV and Solar EUV have almost similar empirical CDF and that the PWV and solar flare index exhibits an inverse relationship. The standard deviation and empirical CDF gradient of PWV are equal to 0.68 mm and 0.5 per mm, respectively, and PWV was observed to decrease by about 0.10 mm during this period. This preliminary study is important for understanding and predicting the Sun's influence on Earth's climate.

General Discussion on Donor Programs

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Session 17: 16:00 – 16:50, Nov. 30, 2006

Panel Discussion on International Collaboration

Session 18: 17:00 – 17:40, Nov. 30, 2006

Panel Discussion on Future IHY/UNBSSI Workshops

Session 19: 09:00 – 10:30, Dec. 01, 2006

Searching the Scholarly Literature Made Easier

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The ADS provides a search system for over 4.8 million records in Astronomy, Solar Physics, Planetary Sciences, and Physics/Geosciences and 3.3 million scanned pages of the scholarly literature, including the entire journal "Solar Physics".

In order to improve access to the ADS and to make searching easier, we allow Google to index the information in the ADS. Since many scientists use Google as their general search system, it makes it easier to also search the scientific literature that the ADS cover. HOWEVER, please be aware that Google does not index all the abstracts in the ADS. Their system crawls the ADS, but may miss some abstracts on a random basis. We therefore recommend for detailed searches to continue using the ADS search system directly.

Since a one-field search system like Google seems to be popular, the ADS have developed such an interface to the ADS as well. The new interface allows you to specify word and author searches in one input field. Author names are detected automatically in the input. Years and year ranges are detected as well. This new interface is available on the ADS homepage or at:

http://adsabs.harvard.edu/basic_search.html

IHY-CAWSES Data base

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In partnership with the CAWSES (Climate And Weather of the Sun-Earth System) program, IHY is sponsoring a series of Virtual Workshops and a special IHY/CAWSES database to provide virtual access of data collected for IHY and CAWSES campaigns. The first of the virtual workshops occurred November 13-17, 2006, and had more than 200 online participants. Online presentation and discussion tools are being refined for future workshops. The IHY/CAWSES database provides a means of entering data into the Virtual Solar Observatory (to provide the maximum and easiest possible access to the data) while still maintaining a close connection to the other data sets used in IHY/CAWSES activities.

Centre for Astronomical Data and Software at Indian Institute of Astrophysics

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We propose to set up a Centre for Astronomical Data and Software (CADS) at the CREST campus of IIA. A Data Centre is many things. At the most basic level, it is simply a place to warehouse astronomical data but this has led in the past to a sterile environment which may not serve the user. We plan, on the model of the Virtual Observatory, to set up a living centre which will proactively serve the needs of the IIA and, more generally, the Indian astronomical community.

IIA has always been a source of data - from Kodaikanal to the Vainu Bappu Observatory (Kavalur) and the Indian Astronomical Observatory (Hanle) - and this will continue into the future with major missions such as TAUVEX or UVIT and with the digitization of the Kodaikanal solar observations. IIA astronomers are further involved with many other missions (SOHO, GALEX, SDSS ...) all with large amounts of data.

Our group will serve as a single node for all data related activities in the Institute where other groups or individual scientists will be able to come for help in, primarily, software development. Science will continue to be driven by the scientist but accessory tools and techniques will be developed by CADS. As we develop, we hope to become part of the global Virtual Observatory community.

Session 20: 11:00 – 13:00, Dec. 01, 2006

Concluding Session

Session: Poster (Nov. 27– Dec. 1, 2006)

Study of Equatorial Spread F using L-Band and VHF Radar (P1)

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An important component of ionospheric plasma irregularity studies in the Indian low latitudes involves the study of the plasma bubbles which produce intense scintillations of the transionospheric satellite signals. In order to investigate the dynamics of plasma density irregularities of different scale sizes, a campaign of observations was conducted during 11 to 15 September 2005 at Gadanki (geog.13.45^{0}N, 79.17^{0}E, geomag. Coor. 4.44^{0}N, 151.73^{0}E), an Indian station. A low latitude spread F event occurred over India during the campaign at the night of 15 September 2005. The observations using dual frequency GPS receiver, VHF coherent backscatter radar, and two ionosondes with some latitudinal separation has been made. Range type spread F on ionograms and radar plume signatures on range-time-intensity maps of the VHF radar on the same day was observed. Using the GPS receiver, the association of the fluctuations in the intensity (S4 ~ 0.36 and 0.39) with the depletions in total electron content (5 and 12 TECU) are seen on the same day which affect the positional accuracy of the GPS by 0.8m and 1.92m. The drift velocity is observed to be high (~30 m/s) and the plasma drift is maximum at 1915LT. The irregularities are observed first at Trivandrum (equatorial station) at 1915hrs, then is observed by GPS receiver and then by VHF radar (off-equatorial station) indicating that the observed bubble is drifting eastward.

Daily Mid-Latitude F2-Region Critical Frequency foF2 Variation with Daily Sunspot Number R (P2)

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Ionosonde data recorded at Kokubunji, Japan (Latitude 35.7 N; Longitude 139.5 E) during a year of low solar activity (1994) and high solar activity (1990) were used in our research work to study the correlation between daily sunspot numbers (R) and the daily mid - latitude F region critical frequency (foF2) for four seasons (Spring, March; Summer, June; Autumn, October; Winter, December). There is a diurnal variation of (foF2) with (R). Trends found over years of solar maximum (1990) are more positive in March and December, but negative in June and October. The year of solar minimum (1994) there are positive trends in June and October, but negative trends in March and December.

Occurrence Pattern of Geomagnetic Storms During the Recent Four Solar Cycles (P3)

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Powerful and unsteady magnetic field spewing away from the active regions of the Sun is known to produce remarkable transient interplanetary disturbances and geomagnetic storms. Long-term trend with 11-year cycle is known to be the dominant periodicity in the sunspots, which are areas of strong magnetic field and tend to influence the geomagnetic activity. Due to the abrupt release of magnetic energy associated with these spots, large geomagnetic storms are experienced at the earth following the earth-directed coronal mass ejections (CMEs) of huge bubbles of plasma and magnetic field, emanating from the solar corona. The immediate manifestation of the interplanetary shocks is seen on the ground magnetic records as an abrupt increase in the northward component of the earth's magnetic field. Subsequently, the processes of energy transfer from the solar wind to the magnetosphere-ionosphere system under favorable interplanetary conditions give rise to the main phase of the geomagnetic storm. Measurements of the geomagnetic field variations from low latitudes form highly reliable base to understand the energy influx through the Sun-Earth interactive processes. In contrast to the systematic linear trend seen in the sunspot activity and the storm occurrence pattern observed during the period 1900 to 1965, for almost 7 solar cycles, geomagnetic activity has exhibited multiple peak signatures during the recent cycles. Though the configuration of the interplanetary magnetic field is a dominant part of the coupling process, storm manifestation is not a simple phenomenon. Highly modulating features observed in the storm development pattern during the solar cycles 20-23 will be discussed on the basis of the observed geomagnetic field variations recorded at equatorial and low latitude locations in India and the possible influences of solar wind and interplanetary characteristics.

Differences Between CME Associated and CH Associated RED Events During 2005 (P4)

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As Part of study of RED (Relativistic Electron Decrease) events at Geostationary orbit, we have classified them on the basis of their solar cause. We find that the solar causes associated with RED events (J.J.Lee et.al., 2006) are Interplanetary Shocks (IPS), Coronal Mass Ejection (CME), Coronal Hole (CH), Flares, Magnetic Clouds and Corotating Interaction Regions (CIR). For present, we have taken CME and CH associated RED events during 2005. We study Interplanetary parameters (i.e. solar wind Velocity (V_{sw}), solar wind Ion density (N_{sw}), solar wind dynamic pressure (P_{dsw}), total Interplanetary magnetic field B along with its north-south component, B_z), Radiation belt parameters at geostationary orbit (i.e. electron flux>2Mev, Hp component (i.e. the component of magnetic field parallel to the spin axis of the satellite) and dayside magnetopause distance (MP)) and the geomagnetic indices (i.e. Dst, K_p and CRNM count). The parameters which show significant differences between CME and CH events are V_{sw}, P_{sw}, B, B_z, Dst and K_p, with V_{sw} and Dstc showing the largest differences. As typical examples, in the case of the CME of 22nd January, 2005, Vsw touches over 975 km/sec and Dst is Sudden Storm Commencement (SSC) type with minimum Dst being – 110 nT. In the case of the CH of 5th April, V_{sw} is only 650 km/sec and Dst is of Gradual Commencement (GC) type with minimum Dst of -80 nT. In this paper we present differences observed in the above mentioned parameters for several RED events associated with CME and CH during 2005.

Investigations of the Speed-Distance Profile of CMEs in the SOHO/LASCO Field of View (P5)

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We considered the height-time data of the 307 CMEs observed using SOHO/LASCO during January - March 2005. In order to study the speed profile of the CMEs, we have used only 116 events for which there are at least 10 data points in the LASCO C2 and C3 range. Using this data, we have obtained the speed-distance profile and fitted it with linear fit. From this fitting, initial speed, limb speed and growth rate (dv/dh) are obtained. The results of this analysis are: (i) The initial speed obtained from the first two data points is in the range 24 - 1208 km/s that is nearly similar to the range of linear speed (67 - 920 km/s) obtained from the least square fit of all the data points. (ii) Nearly two thirds of the events (74/116) are found accelerating; (iii) The growth rate is within the range -0.058 to 0.061 s^{-1}; (iv) Though the average of linear speed and initial speed are similar (around 380 km/s and 320 km/s, respectively), the initial speed or limb speed is better correlated with acceleration and growth rate than the linear speed; (v) However, the final height reached by the CMEs very weakly depend upon the initial speed or limb speed where as it depends strongly on the linear speed; (vi) The solar wind speed estimated from the initial speed versus acceleration plot is 375 km/s, where as, the same obtained from linear speed-acceleration graph is around 525 km/s. It seems from the above results that the initial speed of CMEs in the LASCO range and the drag due to the solar wind are important for the propagation of CMEs.

Relation Between Low Latitude Pc3 Magnetic Micropulsations and Solar Wind (P6)

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Geomagnetic pulsations recorded on the ground are the signatures of the integrated signals from the magnetosphere. Pc3 Geomagnetic pulsations are quasi-sinusoidal variations in the Earth's Magnetic field in the period range 10-45 seconds. The magnitude of these pulsations ranges from fraction of a nT (nano Tesla) to several nT. These pulsations can be observed in a number of ways. However the application of ground based magnetometer arrays has proven to be one of the most successful methods of studying the spatial structure of hydromagnetic waves in the Earth's Magnetosphere.

The solar wind provides the energy for the Earth's magnetospheric processes. Pc3-5 geomagnetic pulsations can be generated either externally or internally with respect to the magnetosphere. The Pc3 studies undertaken in the past have been confined to middle and high latitudes. The spatial and temporal variations observed in Pc3 occurrence are of vital importance because they provide evidence which can be directly related to wave generation mechanisms both inside and external to the magnetosphere. At low latitudes ($L < 3$) wave energy predominates in the Pc3 band and the spatial characteristics of these pulsations have received little attention in the past.

An array of four low latitude induction coil magnetometers was established in south-east Australia over a longitudinal range of 17 degrees at L=1.8 to 2.7 for carrying out the study of the effect of the solar wind velocity on these pulsations. Digital dynamic spectra showing Pc3 pulsation activity over a period of about six months have been used to evaluate Pc3 pulsation occurrence. Pc3 occurrence probability at low latitudes has been found to be dominant for the solar wind velocity in the range 400-700 Km/sec. The results suggest that solar wind controls Pc3 occurrence through a mechanism in which Pc3 wave energy is convected through the magnetosheath and coupled to the standing oscillations of magnetospheric field lines.

Structural and Dynamical Properties of Interplanetary Magnetic Clouds in the Heliosphere and their Interaction with Earth's Magnetosphere (P7)

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Space-borne and earth-based detectors are monitoring coronal mass ejections (CMEs) launched from the sun into the heliosphere. A subset of CMEs, called interplanetary magnetic clouds (IMCs), shows systematic rotation (northward to southward and vice versa) in their field structures. The IMCs have been identified in the heliospheric plasma and field data. These IMCs, observed at 1 AU, have been observed to show different dynamical properties. Some of them are, (a) isolated structures moving with the ambient solar wind, (b) faster moving IMCs drive a shock/sheath region formed due to compression of the ambient plasma/field ahead of them, and (c) a fraction of IMCs are driven by fast solar wind from coronal holes forming interaction region (IR) between IMCs and high speed solar wind streams (HSS). The interaction of the solar wind and the earth's magnetosphere is complex and phenomenology of interaction is believed to be very different for solar wind dominated by transient ejecta (e.g. IMCs) compared to solar wind dominated by interaction regions and high speed streams from open field regions of coronal holes. Using different sets of IMCs, we have done a detailed study of their interaction with the magnetosphere and the geoeffectiveness of IMCs and their associated features (shock/sheath, IR and HSS). We have further studied the geoeffectiveness of northward to southward turning and southward to northward turning IMCs along with their associated features. To study the mechanism that produces the geomagnetic disturbances, we have further utilized the heliospheric plasma and field parameters namely, velocity, density, temperature, field strength and its north-south component, during the passage of these structures with different plasma/field properties. Noticeable differences in the geoeffectiveness of IMCs with different structural and dynamical properties have been observed. Correlation analysis between geomagnetic parameters and various heliospheric plasma/field parameters during passage of structures with different properties in done in order to identify the parameters playing important role, and their relative importance, in creating geomagnetic disturbances during their passage.

Solar Observations as Educational Tools (P8)

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Solar observations are very handy tools to expose the students to the joy of research. In this presentation I briefly discuss the various experiments already done here with a small 6" Coude refractor. These include simple experiments like eclipse observations, rotation measurements, variation in the angular size of the sun through the year as well as sun spot size variations, Doppler measurements, identification of elements from solar spectrum (from published high resolution spectrum), limb darkening measurements, deriving the curve of growth (from published data). I also describe the theoretical implications of the experiments and future plans to develop this as a platform for motivating students towards a career in basic science research.

Intensity and Velocity Oscillations in Magnetic Flux Concentrations (P9)

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We analyzed intensity and velocity oscillations in magnetic network using high-resolution 2D spectral scan images from Interferometric Bi-dimensional Spectrometer (IBIS). In photosphere, oscillations in intensity and velocity in 2-5.2 mHz band shows reduced amplitude while at higher frequencies 5.2-7.0 mHz and 7.3-25.8 mHz band oscillations amplitude enhance in line core intensity and shows reduced amplitude in line core velocity however in chromosphere the oscillations have different character, we found higher power in 2-5.2 mHz, 5.2-7.0 mHz and 7.3-25.8 mHz band in core velocity compared to core intensity. Amplitude variation with height is also inferred from our analysis. These findings are manifestation of high frequencies halos around strong flux concentrations (pores) in intermediate field strength network and mode conversion of solar p-modes in magnetic fields.

Solar Cycle Effects on Equatorial Electrojet Strength and Low Latitude Ionospheric Variability (P10)

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The most obvious indicators of the activity of a solar cycle are sunspots, flares, plages, and soon. These are intimately linked to the solar magnetic fields, heliospheric processes which exhibit complex but systematic variations. The changes in geomagnetic activity, as observed in the ground magnetic records follow systematic correspondence with the solar activity conditions. Thus the transient variations in the magnetic field get modified by differing solar conditions. Also the solar cycle influences the Earth causing changes in geomagnetic activity, the magnetosphere and the ionosphere. Daily variations in the ground magnetic field are produced by different current systems in the earth's space environment flowing in the ionosphere and magnetosphere which has a strong dependence on latitude and longitude of the location. The north-south (Horizontal) configuration of the earth's magnetic field over the equator is responsible for the narrow band of current system over the equatorial latitudes and is called the Equatorial electrojet (EEJ) and is a primary driver for Equatorial Ionization anomaly (EIA). Equatorial electric fields and plasma drifts play the fundamental roles on the morphology of the low latitude ionosphere and strongly vary during geomagnetically quiet and disturbed periods. Quantitative study is done to illustrate the development process of EEJ and its influence on ionospheric parameters. An attempt is also made to examine and discuss the response of the equatorial electrojet parameters to the fast varying conditions of solar wind and interplanetary parameters.

Optical Observations of Solar Activity Observed on April 5, 2006 at Kolhapur (P11)

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While making observations of sunspots on April 5, 2006 by optical solar telescope (Celestron 5" reflector) with advanced high resolution digital CCD camera, we observed a solar flare on the eastern limb at 08:09:46 UT and an ejected blob of a solar material at 08:14:34 UT, probably emitted due to Coronal Mass Ejection (CME) behind the eastern limb of the sun.

After processing the images using 'Digital Image Processing' techniques, we conclude that there must be an existence of a group of sunspots behind the limb of the Sun, which are closely associated with these two events. During the period 9-14 April, the sunspots regions 870, 871 and 872 came on the front side of the sun due to solar rotation.

The data from SOHO-EIT, LASCO, GOES-SXI are used for the comparative study of these two events. In this paper, an attempt has been made to suggest a model responsible for the occurrence of these events in quick succession.

Installation of Induction Coil Magnetometer LEMI-301 and Data Processing System for Prediction of Earthquake at Shivaji University, Kolhapur (16.40°N, 74.15°E) (P12)

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Induction coil magnetometer LEMI-30I and data processing system has been installed at Shivaji University Kolhapur since December 2005, under a project of D.S.T., New Delhi. The system consists of three induction coil magnetic sensors LEMI-30I and communication and data processing system CAM-unit which has come from Ukraine (Russia). Data acquisition from this system is going on. We describe the system, its installation, data acquisition & some interpretation of the data. We shall see correlation of this data, if any, with that of the data obtained from seismograph (sensitive to vibrations) which is already installed and running in our department.

Proposal for Creating a Center for Research in Solar-Terrestrial Physics as an Inter-departmental Activity during IHY at Shivaji University, Kolhapur (16.40°N, 74.15°E) (P13)

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The Department of Physics, Shivaji University has started M.Sc. (Physics) degree course with a specialization in space science with effect from 1991. Emphasis has been given to the subject of Solar-terrestrial Physics, Astronomy and Astrophysics. The Indian Institute of Geomagnetism, Mumbai and The Physical Research Laboratory, Ahmedabad gave considerable help in starting teaching and research activities by providing instrumentation for experiments related to solar-terrestrial physics. Presently we have Solar Microwave Radiometer, Night Airglow Photometer, Proton Precession Magnetometer, Partial Reflection Radar, Satellite Radio Scintillometer, Automatic Weather Station, Earthquake Prediction and Detection equipments. In addition, there is a Celestron 5" Telescope for optical observations of the Sun, Planets and other celestial phenomena like comets, eclipses etc. With the addition of optical filters such as H-alpha (6563A°) and Helium-I (10830A°) filters, solar flares and coronal holes can be monitored using ground based optical telescope. In order to make the experimental setup more complete, a research project proposal is being submitted to DST Govt. of India requesting funds for a Digital Ionosonde, GPS System, Riometer and a Flux-gate Magnetometer and a ST Radar for measurements of wind velocity, waves and turbulence phenomena in the stratosphere and troposphere. This proposed ST Radar and Partial Reflection Radar data can yield valuable data on the dynamics of the middle atmosphere, which is important for the study of sun-weather relationship including chemical and environmental processes in the middle atmosphere. When all the above experiments become operational; a database for STP events can be created with the financial help from DST. Such a database will be a significant contribution from Shivaji University, consistent with the programme of the International Heliophysical Year sponsored by UN/NASA and DST Govt. of India.

Solar Control of Ambient Ionization of the Ionosphere near the Crest of the Equatorial Anomaly in the Indian Zone (P14)

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Ionospheric total electron content (TEC) has been measured at Calcutta (22.580 N, 88.380 E geographic, dip: 320 N), which is situated virtually below the northern crest of equatorial anomaly over a period 1979-90. This paper presents possibly for the first time a long term study on the control of solar activity over the total electron content of the ionosphere covering both the increasing (1986-90) and decreasing (1979-85) phases of solar activity. The TEC at this location is controlled by production due to solar EUV fluxes, the so-called equatorial fountain effect due to electrodynamics drift and neutral wind. 10.7 cm (2800 MHz) solar flux is considered as a surrogate index of solar EUV flux. Starting from the early morning hours, TEC increases with solar flux. A good correspondence between the two is reflected throughout the increasing and decreasing solar activity periods. Moreover no saturation effect is observed in the TEC variation at high levels of S10.7 flux. The correlation coefficient, R^2 maximizes mostly in the 08-10 IST time slot, indicating a greater solar control and sometimes more or less the same value persists for several hours later. R^2 values in the declining phase is somewhat lower compared to that in the increasing phase but minima in the R^2 appear in both the phases at about 10-14 IST primarily. The minima suggest less solar control over TEC compared to other geophysical parameters. In the equinoctial months minima are observed at the afternoon hours and this suggests that during the equinoctial months other than solar flux, fountain effect caused by electrodynamic drift is more prominent. A pronounced hysteresis effect with the solar activity is observed in various months during the time intervals (6-8 IST), (12-15 IST) and (18-20 IST) and the effect is most sensitive in moderate to high solar activity period. One remarkable feature of TEC variation with 10.7cm solar flux is that for few months TEC of the declining phase (1979-85) revert positions with respect to that of the increasing phase (1986-90). It occurs for more or less same values of solar flux in the time interval (10-14 IST) of moderate to high solar activity periods. The same feature is occasionally repeated around the post midnight period also –though it is not under direct solar control. Seasonal variation of TEC, considered as a result of fountain effect modulated by neutral wind, both zonal and meridional components, is also observed to be influenced by solar activity with asymmetrical nature in increasing and decreasing phases. Long term studies on solar radiation and TEC from Calcutta reveal that ionization around the equatorial anomaly crest is greatly influenced by the sun with asymmetrical variations in the increasing and decreasing phases. The study will be useful in predicting the ionospheric group delay of trans-ionospheric signal as used in GPS and other systems.

Solar Shape Changes and Oscillations from Space (P15)

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The diameter was observed to be constant over the last solar cycles and, as such, is not a "proper" solar-terrestrial "climate" indicator. Ground measurements with small telescopes are spurious diffraction and seeing affected, the Maunder Minimum ones of Picard during the XVII century not being an exception. Large instruments (like the 45 cm Gregory's of A. Wittmann in Locarno and Tenerife) that average seeing cells see no variations (< 40 mas) and, as well, space instruments (MDI/SOHO) that are naturally not affected by turbulence. We present the four approaches, Wittmann on ground with large telescopes, Kuhn et al. (2004) who used the six pixels limb data of MDI, Antia (2003) with a completely different method since using the ultra-precise frequency variation of the f-modes, and our approach (Damé and Cugnet, 2006) using seven years of MDI filtergrams data (150 000 photograms and magnetograms). These four careful analyses converge towards the same insignificant variations (below 15 mas for space experiments or even less: 0.6 km, 0.8 mas for the helioseismology approach!). Following Antia, we conclude that: "If a careful analysis is performed, then it turns out that there is no evidence for any variation in the solar radius." There were no theoretical reasons for large solar radius variations and there is no observational evidence for them with consistent ground and space observations. This being said, the radius measurements are of interest for the solar shape changes that might occur along the cycle (sub-surface convective flows?). Radius oscillations (but higher in the atmosphere, further in the UV: 220 nm) might also bring up low order p-modes and, eventually, g-modes if ever accessible. At the level of formation of the 220 nm continuum there is the maximum magnification of the p-modes and intensity oscillations. 220 nm is also the Lyman Alpha absorption region and ozone formation layer. A New Solar Shape and Oscillation Telescope (NSSOT) is proposed and designed along the non-degraded UV imaging concept developed earlier for SODISM/PICARD (Damé, et al., 1999, 2000, 2001), optimized for these measures of solar shape and oscillations at 220 nm. It has a carbon-carbon structure, SiC mirrors, no window and no spurious optics affecting thermal behavior and scattered light. A model of simplicity and precision. Lyman Alpha and UV images, in selected wavelengths, will complete these measurements. We present the design and bread-boarding activities (SiC thermally controlled mirrors) of NSSOT, and its scientific revisited objectives.

Lighting-induced Electron Precipitation (LEP) Events versus Geomagnetic Activity: A Probe Tool to Re-Evaluate the Electron Radiation Belt Loss Mechanisms (P16)

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We present the first results of an incipient attempt to re-model the Van Allen electron radiation belts equilibrium mechanisms. During the 23rd cycle solar minimum period (1995-1997) the Lightning- induced Electron Precipitation (LEP) events (electron precipitation from the geo-space to the upper Earth atmosphere) occurrence at the Antarctica Peninsula region was collected and studied. With statistical techniques we have reproduced the pattern of the events incidence during that period. The year 1998 was also analyzed and two well-defined geomagnetic storms (01-07 May and 26-31 Aug) were studied in association with the Trimpi events data. We have confirmed the narrow relationship between events occurrence rate and geomagnetic activity. The next step, in order to carry on the model, will be the modeling of the solar maximum LEP occurrence and to compute these results in the present radiation belts population models.

Space Science Resource Centre for Colleges in Kerala (P17)

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Several Space missions are now providing valuable data about the terrestrial and heliospheric environments .In order to encourage research and human resource development in basic space sciences we propose to establish a Space Science Resource Centre (SSRC) in the state of Kerala in India. This centre will maintain relevant data bases and software tools to promote space science activities in more than 220 science/engineering colleges in Kerala. The target student population is about 0.2 million. The detailed plan, programme and requirements of the proposed SSRC during the IHY-2007 will be presented.

Solar Vector Magnetograph at Udaipur Solar Observatory: New Results (P18)

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A new Solar Vector Magnetograph has become operational at Udaipur Solar Observatory. The magnetograph is a straight telescope with no net instrumental polarization. The instrument consists of servo stabilized Fabry-Perot etalon which acts as a tunable narrow band filter. A dual beam polarimeter is designed to overcome seeing induced spurious polarization effects. The polarimeter modulator consists of two quartz waveplates mounted in a precision rotary mount. The polarization is measured at different wavelength positions across the spectral line. The polarized line profiles thus observed are reduced and inverted under Milne-Eddington inversion scheme. I would like to present the details of the instrument and its observational capabilities. Also, the data analysis and reduction software will be described.

Burst of ULF Electric Field Recorded by DEMETER Possibly Related to the Series of Earthquakes Occurred during the Tsunami Over the Indian Region (P19)

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The scientists have found that the accumulation of tectonic energy is localized in certain places and is not universal. Taking into account this hypothesis the authors have studied the sequence of occurrence rate of the earthquakes (M≥5) in the South-East Asian region, as the chronological data related to the occurrence of earthquakes collected in that region for last five years i.e. from 2001 to 2005 have revealed that the disastrous tsunami events which took place on 26th December, 2004 as an effect of Sumatra earthquake(M=9) have increased the occurrence of earthquake frequency for a longer period (which might be due to adjustment of tectonic plates). Observing these facts i.e. sudden enhancement in occurrence rate of earthquakes, the authors have availed this opportunity to further explore the concept of seismoelectromagnetic-ionospheric phenomena, which still needs a lot of statistical evidences, comprising tremendous amount of data to establish it. In this paper the authors have tried to analyze the chain of observations made and data collected and stored month wise w.e.f. 26th December, 2004 to 31st March, 2005 in the region, using DEMETER satellite. Further, efforts have also been made to provide the statistical analysis of the ionospheric variability caused due to detected electromagnetic burst in ULF frequency ranges in the context of natural variability in order to distinguish the variability introduced by other sources. In brief, it could be concluded that there is possibility of getting the electromagnetic precursors in the ionosphere at different frequency ranges due to excess release of tectonic energy as a result of occurrence rate of the earthquakes in the region.

Long Term Variations of the Solar Cycle: Forecast of the Future Cycles (P20)

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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 Maunder-minimum type of solar activity, with a period of ~ 100 years, is explained as a result of coupled poloidal and toroidal MHD oscillations.

Using the obtained amplitudes, frequencies and the phases of the previous 22 solar cycles, we forecast the amplitude (maximum sunspot number) and period of the present solar cycle (23) that match very well with the observations. The period of the present cycle is found to be 11.73 years. With these encouraging results, we forecast the profiles of future 15 solar cycles. Important findings are : (i) the period and amplitude of the cycle 24 are 9.34 years and 116 (plus or minus 12), (ii) the period and amplitude of the cycle 25 are 12.49 years and 110 (plus or minus 11) and, (iii) the sun might experience a very low (around 60) sunspot activity during 2089-2100 AD (cycle 31).

Role of Ambient Solar Wind Conditions in CME evolution (P21)

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Solar events are mainly responsible for producing storms at the Earth. Coronal Mass Ejection (CME) is a major cause for this. In this paper, Coronal Mass Ejections occurred during 1998-2004 are studied. Ambient solar wind does play some role in determining the effect of a CME. The effects produced at the Earth during the period 1999 – 2004 are considered and an attempt has been made to understand the role of ambient solar wind. This is to draw some conclusion about how some of the events become geo-effective.

Coronal mass ejections of 28 October 2003 & 14 November 2003 and Associated Space Weather Effects (P22)

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The effects of Halo Coronal Mass Ejections (CMEs) erupted on 28 October 2003 and 14 November 2003 are studied and reported here. The signatures of these events in the interplanetary medium (IPM) sensed by Ooty Radio Telescope, the solar observations by LASCO Coronagraph onboard SOHO, GOES x-ray measurements, satellite measurements of the interplanetary parameters, GPS based ionospheric measurements, the geomagnetic storm parameter Dst and ground based ionosondes data are used in the study to understand the space weather effects in the different regions of the solar-terrestrial environment. The effects of these events are compared and possible explanations attempted.

Properties of Large Angle CMEs and Their Space Weather Effects (P23)

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Using IPS observations, CMEs (Coronal Mass Ejections) have been detected over the entire Sun-Earth distance (Manoharan et al. 1995). The effects of large CMEs (angular width $>150^0$) are studied and reported here. The effects of such CMEs on the interplanetary medium (IPM) are sensed by the Interplanetary Scintillation (IPS) recorded at Rajkot and at Ooty. The Radio Telescope detects the signatures of Interplanetary Disturbances resulting either from CME or CIR (Co-rotating Interaction Region). The solar observations of these CME and associated events are presented. We also discuss the space weather aspects of CMEs.

Solar and Interplanetary Causes of Geomagnetic Storms 1996-2005 (P24)

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The effect of (i) solar activity indices such as sunspot number (SSN), solar flux (SF), solar flare index (SFI), coronal index (CI) and cosmic ray intensity (CRI) and (ii) solar features such as Hα, X-ray solar flares, APDFs, CMEs and Coronal Hole Intensity (CHI) on geo-sphere have been investigated for solar cycle 23. It is observed that SSN, SF, SFI and CR shows maximum peak during the odd month whereas CI shows during the even month. The time lag between the CRI and solar activity is almost the same except for the CI. There is strong N-S asymmetry for solar cycle 23. An overall northern bias apparently prevails for solar flares and active prominences and disappearing filaments (APDFs). Hα and X-ray solar flares occurring over the western limb of the solar disk cause larger disturbances in magnetosphere leading to occurrence of Intense (Dst <-100nT) GMSs whereas those solar flares which occur on the eastern limb of the solar disk lead to occurrence of Major (-50nT > Dst ≥-100nT) and Minor (-20nT ≥ Dst ≥ -50nT) GMSs. It is observed that Coronal Hole Intensity (CHI) is maximum for Minor GMSs followed by Major and Intense GMSs where as, mean CHI is maximum for Intense GMSs followed by Major and Minor GMSs. High Speed Solar Wind Streams (HSSWS), CMEs originated from the coronal holes have much greater ability to produce GMSs. The results show that the product of Vsw. Bz_{min} and Vcme. Bz_{min} along with minimum DST of the SSC day are the reliable predictors of the intensity of GMSs.

Interplanetary Transient Solar Wind Plasma Flows and Their Influence on the Geomagnetic Activities (P25)

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Geomagnetic storms are well known to be associated with solar and interplanetary magnetic activities. In the present study, we consider two types of solar wind plasma flow phenomena, namely, magnetic cloud events and bidirectional electron heat flux events and discuss their short-term changes and analyze their association with coronal holes. We select those events that took place during solar maximum. Analysis reveals distinctly different effects of these two signatures on geomagnetic field. Magnetic cloud events are found more effective comparing to bidirectional events on short-term basis.

Storm Time Equivalent Currents Derived from a Meridional Magnetometer Chain and the Investigation of Associated Dynamics using a Numerical Model of the Ionosphere (P26)

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There is a need for modeling ionospheric sheet currents locally, over a certain region using ground based and/or satellite observations to help us better understand the physics of changes happening during geomagnetic storms. Our interest is to investigate storm-time changes in the low-latitude ionosphere, by taking into account the coupling between high- and low-latitudes. We use magnetic data from the 210 degree meridian chain and calculate the ionospheric (~120km) sheet currents for geomagnetic storms of varying intensities, spanning different seasons and solar cycle. Many factors contribute differently to the observed H component variations and one needs to address those using case-based arguments, since quantifying them is difficult task. We separate the observed H-component into external and internal parts and then continue the external component towards the source to arrive at the ionospheric equivalent currents. It is also hoped to discuss the storm-time dynamics and the associated changes in the low-latitude ionosphere using the derived electrodynamic parameters (conductivities, electric fields) which are then input to an existing numerical model of the ionosphere. We hope that the application of the algorithm to different meridional chains (accounting for the interpretation of conductivity – interdisciplinary (magnetotellurics) - and wavelengths in the spatial domain) will facilitate and further our understanding of these non-linear phenomena and positively contribute towards the basic space science activities of the upcoming IHY.

Magnetic Flux in the Solar Convective Envelope Inferred From the Sunspots' Initial Appearances (P27)

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Sunspots with different life spans suggest their origin at different depths. By measuring magnetic fluxes from their first observation on the surface, one can estimate the strength of magnetic flux at different anchoring depths in the solar convective envelope. We measure initial fluxes of the sunspots on the solar surface using SOHO/MDI magnetograms. Hiremath's (A&A, 386, 674, 2002) sunspots "life span-anchoring depth" information in the solar convective envelope and Parker's (ApJ, 121, 491,1955) flux tube model are used for the estimation of the strength of the magnetic flux and the rate of emergence of magnetic flux at different anchoring depths. Important findings are: (i) majority of the spot groups that have first appearances on the surface are bipolar, (ii) irrespective of their sizes, the bipolar spots with different life spans have average magnetic field strengths of ~ 600G during their first observation,(iii) With a view to measure the strength of initial magnetic fluxes for a long stretch of Greenwich sunspot data, the initial area – magnetic flux relationship is obtained, (iv) the average field strength at the site of anchoring depths of the sunspots is estimated to be ~10^6 G near base of the convective envelope and ~ 10^4 G near the surface, (v) the dynamo-a source of sunspot activity-is distributed through out the convective envelope, (vi) the rate of emergence of initial magnetic flux of such a distributed dynamo near base of the convection zone is 10^{19} Mx/day and is two times the rate of emergence of initial magnetic flux near the surface.

Changes in Heliophysical Parameter Influence on Environment of the Earth (P28)

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Terrestrial as well as extraterrestrial satellite data and environmental parameter records were correlated. It has been observed that there are some relationships existing between the changes in environment and extraterrestrial phenomenon. The star flare changes the cosmic parameters. Nearest star of earth the Sun is found to be under the influence of the star flare. It has been observed that there is some relationship in between the planetary indices (Kp) Electron flux (E flux) Proton flux (P-flux) of Sun-Earth environment with the changes in thermosphere, ionosphere, atmosphere and geosphere. Tsunami of 6th December 2004, abnormal snowfall in 2004-2005, sudden hike in global temperature and erratic monsoon in India and irregular rainfall in other parts of the world in 2006 followed by torrential rain are the impact of the star-sun-earth relationship.

The Malaysian Robotic Solar Observatory (P29)

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Robotic observatory with small telescopes can make significant contributions to astronomy observation. They provide an encouraging environment for astronomers to focus on data analysis and research while at the same time reducing time and cost for observation. The observatory will house the primary 50cm robotic telescope in the main dome which will be used for photometry, spectroscopy and astrometry observation activities. The secondary telescope is a robotic multi-apochromatic refractor (maximum diameter: 15 cm) which will be housed in the smaller dome. This telescope set will be used for solar observation mainly in three different wavelengths simultaneously: the Continuum, H-Alpha and Calcium K-line. The observatory is also equipped with an automated weather station, cloud & rain sensor and all-sky camera to monitor the climatic condition, sense the clouds (before raining) as well as to view real time sky view above the observatory. In conjunction with the Langkawi All-Sky Camera, the observatory website will also display images from the Malaysia - Antarctica All-Sky Camera used to monitor the sky at Scott Base Antarctica. Both all-sky images can be displayed simultaneously to show the difference between the equatorial and Antarctica skies. This paper will describe the Malaysian Robotic Observatory including the systems available and method of access by other astronomers. We will also suggest possible collaboration with other observatories in this region.

MHD Waves in Homogeneous Plasmas (P30)

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We show that a general dispersion relation for MHD waves in homogeneous plasmas is always a six-order polynomial. Taking account of viscosity and thermal conductivity as damping mechanisms, we present its solutions for all the three MHD modes: slow, fast and thermal. We note that thermal mode is excited only when thermal conductivity is present. The damping of both slow and fast mode waves depends on the plasma physical parameters, such as density, temperature, magnetic field and orientation of the background magnetic field. We discuss the consequences of our results to the coronal heating problem.

Ionospheric Scintillations Induced by Sporadic-E Irregularities Over Low Latitude (P31)

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The observations of daytime ionospheric scintillation are attributed to E-region irregularities at high and equatorial latitudes. In this paper, VHF amplitude scintillations recorded during the daytime period from 1991 to 1993 at low latitude station Varanasi (geomag. lat. $14^0\ 55^/$ N, long. 154^0 E) are analyzed to study the behavior of sporadic-E irregularities during the active solar and magnetic periods.

The amplitude scintillations of 250 MHz signal transmitted from geostationary satellite FLEETSAT situated at 73^0E longitude is monitored using a VHF receiver and chart recorder. In addition to the normal chart recording, data were also recorded digitally at a sampling rate of 10Hz on a few days. The daytime digital scintillation data have been analyzed to study some important parameters of scintillation producing sporadic-E irregularities like auto-correlation function, power spectral densities, signal de-correlation time etc. We report the behavior of these parameters under weak and strong scintillation conditions. Results of these studies yield information about the sporadic-E irregularity structures, its shape and size. Derived spectral index ranges between –2 and –10 and the characteristics length of sporadic-E irregularities varies from 150m to 3000 m. The estimated characteristic of these irregularities depends on the velocity and hence we estimate the minimum and maximum range of scale length of sporadic-E irregularities, observed in the ionosphere of Varanasi. These results are also discussed in the light of recent works.

Role of Geomagnetic Disturbances on VLF Whistler Wave Activity at Low Latitudes (P32)

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The disturbances on solar surfaces lead to the enhanced injection of energetic charged particles in to the inner magnetosphere, which modifies the electrodynamic features of ionosphere and magnetosphere. The electrodynamic properties control the generation and propagation characteristics of VLF waves. At Varanasi station, which is one of the low latitude stations in India, we have recorded VLF waves from 1992 onwards. The source of VLF wave is natural lightning discharges. Whistler activity varies with latitude having maximum around 50^0 geomagnetic latitude. The occurrence rate is low at low latitudes and also depends on the solar and geomagnetic conditions.

In this paper, we report the results derived from the statistical analysis of whistler waves recorded at Varanasi during the period January 1990 – December 1999. The monthly occurrence rate is obtained which shows maximum during January to March. Seasonal variation of the occurrence rate is also studied. In order to study the role of geomagnetic disturbances on the occurrence rate, we have used Kp index and its variation. It is observed that the occurrence probability monotonically increases with $\sum K_p$ values. It is observed that when $\sum K_p > 10$, the occurrence rate is greater than the average value. This tendency is found to be in good agreement with those reported by other workers. In addition, we also present the probability of observation of whistler waves during the weak/intense geomagnetic storm. Detailed result of occurrence of whistler waves during the main phase and recovery phase of geomagnetic storms will also be presented. An attempt will be made to present explanation of these statistical results.

Initial Results of Ionospheric Parameters at Surat (21.16°N,72.78°E) using GPS Satellite Signals (P33)

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GPS Signals provide an excellent means for measuring the ionospheric effects in terms of Scintillation Indices, Variations in Total Electron Content (TEC), Lock Time, etc. along the path of propagation of trans-ionospheric signals from GPS satellites because they are continuously available and can be measured through many points of the ionosphere simultaneously.

Present paper reports the initial results obtained with a sophisticated GPS based Scintillation and TEC monitor at Surat, India (21.16°N,72.78°E Geog.). Future course of study is also discussed.

Mesospheric Winds from 60 to 100 km Over Low Latitude Station Kolhapur by Partial Reflection Radar (P34)

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Temporal variation of daily winds between the 60 to 100km height regions from the data collected using spaced antenna medium frequency MF. Partial Refection Radar located at Kolhapur (16.40^{o}N, 74.15^{o}E; Geomagnetic, dip latitude 10.6^{o}N), India, is presented in this paper. Sequential wind profiles are obtained by using partial reflections. Mesospheric mean winds and their daily variation in the horizontal components are presented in detail. The motions implied by mesospheric drifts closely resemble movements of the neutral air. The detailed study of the seasonal variations of the zonal, meridional and vertical winds will be presented.

Understanding IMF B_z and Space Weather Relations Near Geomagnetic Equator Related to Non-Radial Solar Wind Flows (P35)

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We have reported earlier some new results related to the seasonal and solar cycle changes in the north-south component of IMF (B_z) observed near 1 A.U. A relationship between geomagnetic activity and non-radial solar wind flows were reported recently. In this connection, we are planning some studies for IHY 2007. We propose to identify non-radial flow structures in the interplanetary medium using IPS observations and predict the associated IMF B_z structures. The effect of geomagnetic storms near magnetic equator associated with non-radial solar wind flows will be studied using magnetometer observations in Trivandrum.

Morphology of Equatorial Electrojet over the West African Sector (P36)

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The temporal variations of the landmark and current parameters of the equatorial electro-jet over the West African sector have been evaluated from Onwumechili's thick current shell format of continuous current distribution model of equatorial electro-jet using a set of data taken during the International Equatorial Electro-jet Year (IEEY). The thick current shell model which takes into account the vertical ionospheric currents permits both the width and the thickness of the jet to be determined simultaneously. The variations of the landmark and current parameters of equatorial electro-jet (EEJ) exhibit consistent diurnal variations. Generally, the EEJ intensity current parameters, including forward current and current density and current intensity increase from dawn, reach the peak at about local noon and thereafter decay towards sunset. The landmark parameters such as current width and latitudinal extent of the current also increase from dawn towards the local noon and thereafter begin to decrease towards sunset. The dynamics of the variation of electro-jet intensity and thickness shows that electro-jet shrinks as its intensity increases. The electro-jet centre has a consistent diurnal variation pattern and comes closer to the dip equator at about local noon when the intensity of the jet maximizes. The thin current shell model best fits only the near local noon jet observation, as the electro-jet is thinnest at the period of maximum intensity. The transient variation of the jet thickness is explained in terms of the wind shears in consistency with the electrodynamics of the dynamo region.

Variability of Equatorial Ionosphere Inferred from Geomagnetic Field Measurements (P37)

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This paper investigates variability of equatorial ionosphere using ground based geomagnetic field data of horizontal and vertical field intensities obtained during the IGY-Cooperation, at the equatorial station of Ibadan (07.22°N 03.58°E). The ionospheric current responsible for the magnetic field variations is inferred to rise from early morning and attained maximum at about local noon. The day time variation in the resultant solar quiet daily variations Sq in horizontal and vertical field intensities Sq(H) and Sq(Z), respectively, were generally greater than night time. The rising rate of the Sq(H) is generally greater than the decay rate. The rate of building up of the ionospheric Sq current is faster than its rate of decay after noon time maximum. The vertical drift in the ionospheric current is observed to have seasonal variation.

Inter-relationships Between the Thickness, Width and Intensity of the Equatorial Electrojet in Indian Sector (P38)

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The temporal variations of the thickness, width and current intensity of the equatorial electro-jet over the Indian sector have been evaluated from Onwumechili's thick current shell format of continuous current distribution model of equatorial electro-jet on quiet condition. The thick current shell model which takes into account the vertical ionospheric currents permits both the width and the thickness of the jet to be determined simultaneously. The EEJ intensity increases from dawn, reaches a peak at about local noon, and thereafter decays towards sunset. The thickness and width of equatorial electro-jet EEJ exhibit consistent diurnal variations. The thickness decreases from about 0.06642º at dawn to the minimum at about 1100 hr local time and then begins to increase towards the dusk. The width increases with the sunrise, reach a maximum at about 1100 hr local time and then begin to decrease towards the dusk. The mean annual half thickness and half width for the solar minimum year 1986 (Sunspot number R = 13.4) is 0.0625 + 0.0037º and 2.68 + 0.23º, respectively. The dynamics of the variation of electro-jet intensity and thickness shows that the electro-jet shrinks as its intensity increases. The thick current shell model is shown to give better hourly representation of jet behavior than the thin shell format hitherto being used. The thin current shell model best fits only the near local noon jet observation, as the electro-jet is thinnest at the period of maximum intensity. The transient variation of the jet thickness is explained in terms of the wind shears in consistency with the electrodynamics of the dynamo region.

Our Understanding of Space Weather features responsible for geostationary satellite anamolies (P39)

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The topic of space weather effects on operational anomalies on spacecraft is one of considerable research investigation, with both pure and applied aspects. This is because of the very high costs involved in fabricating and operating spacecraft, and in insuring them against the harmful effects of space weather. This is more true for geostationary satellites than of low-orbiting spacecraft, as the former operate in the high-risk environment of the Earth's outer radiation belts, with its large vagaries in spatial and time variations of high-energy electron and proton distributions (BAKER 2003). Without doubt, plasma and magnetic field emissions from active regions on the Sun are the root cause for spacecraft anomalies. Our study for 2005 shows that over 95% of anomalies can be related to some definite activity on the Sun, ranging from high-speed solar wind streams with their 27-day recurrence patterns/coronal holes/coronal mass ejections preceded by X or M type of flares/and magnetic cloud events. The most energetic solar activity events are generally accompanied by a large rise in solar MeV proton densities at geo-stationary orbit (WILKINSON 1994), and they account for definite anomalies classified as SEU (Single Event Upsets which most often are reversible through resetting commands). Any particles in the low energy ranges (eV and keV, and these could be of magnetospheric or ionospheric origin), are believed to cause external charging effects in exposed parts of the spacecraft such as solar power arrays and power cables. These mainly result in power losses which are debilitating over a period of time.

The most dangerous and often irrecoverable damage is due to electronics in the 1-5 MeV range which cause deep dielectric discharge of arc type in semi-conductors comprising spacecraft instruments. Following major solar activity, the populations of these rise to more than ($5x10^3$) particles/cm^2.ster.sec, with large spatial and time variations (LOVE et al. 2000). When the influence of these relativistic electrons in the neighborhood of geo-stationary spacecraft builds up to values exceeding $10^8/cm^2$.ster.day, satellite anomalies invariably occur.Our study finds that these 'Relativistic electron events' accompanied by satellite anomalies invariably occur following sharp, well-defined shocks in the inter-planetary medium, and we are trying to understand the relationship between the two. We also notice that anomalies due to space weather effects are very satellite-specific, with differing threshold values seen for different satellites.

Study of MHD Surface Waves Along the Interface of the Magneto-sheath, Boundary Layer and Magnetosphere with the Effect of Solar Wind (P40)

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The magnetospheric boundary layer, which is the interface between the magnetosheath and the magnetosphere has been considered to be the plasma slab surrounded by moving and static plasma media on either side. The compressibility effect on surface waves propagating along the slab has been studied. The effect of variation of the boundary layer thickness is studied as a special case, since the observed variation of the boundary layer thickness leads to unstable modes due to Kelvin-Helmholtz instability. The solar wind driven magnetosheath plasma is considered as the moving plasma medium and the effect of velocity of the solar wind is also taken into account.

Proposal for a Longitudinal Network of Upper Atmosphere Diagnostics for the Dip Equatorial Region: Scientific need and Expected Outcome (P41)

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It is increasingly being realized that the unique characteristics of the plasma and neutral domains of the equatorial upper atmosphere exhibit significant longitudinal dependence both during geomagnetically quiet and disturbed periods. The spatial variability of the diurnal development of the equatorial electrojet (EEJ) and of the equatorial ionization anomaly (EIA), post-sunset generation and non-linear development of equatorial F – region plasma density irregularities (plasma bubbles) and forenoon bite-out in F-layer peak density at the EIA rest location and the equatorial midnight temperature maximum (MTM) typifies the longitudinal dependence of the equatorial upper atmosphere system. One of the major scientific needs of the times is therefore to capture and comprehend the longitudinal dependence in all its detail so as to advance our understanding of the equatorial system which reflects, among other things, the myriad couplings within the near-Earth space environment. This calls for the deployment and operation close to the magnetic equator of cost-effective sensors optimally distributed in longitude taking advantage of the landmass in India and its neighborhood, South-East Asia and Brazil. It is worthwhile to note in this context that the thrust of experimental activity thus far had been towards establishment of latitudinal chain(s) of upper atmosphere diagnostics. The sensors that can be deployed as equatorial networks are low cost ionosondes, TEC and VHF/UHF/L-band scintillation monitors, day airglow/night airglow photometers and all-sky imagers, to name a few. This will help derive important information on the longitudinal structures of various scale sizes in the plasma and neutral atmosphere parameters. The recent work of Tsunoda (GRL, Vol 32, L08103, 2005), in fact, revealed the possible role and relevance of the large-scale wave structure (LSWS) in the plasma density of bottom side F-layer to the enigmatic day-to-day variability of equatorial spread-F, and highlighted the need for a cluster of longitudinally distributed ground-based sensors to monitor the upper atmosphere parameters. The Indian scientific community actively seeks and/or contributes to international collaborative and cooperative efforts aimed at the establishment and operation of equatorial ground based networks of radio and optical diagnostics under IHY program in the forthcoming years.

Major Solar Proton Event during September 24-30, 2001 using Imaging Riometer Technique (P42)

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Major outbursts of mass and energy i.e. a fast full halo CME with speed of 2402 km/sec from region 9632, located on the Sun at S16 E23 was observed at 1030 UT by SOHO/LASCO C3 coronagraph on September 24, 2001. The proton event at greater than 100 MeV began at 1440 UT on 24 September, reached a maximum of 31.2 PFU at 0755 UT on 25 September and ended at 1940 UT on 26 September 2001. The protons event at greater than 10 MeV began at 1215 UT on 24 September, reached a maximum of 12,900 PFU at 2235 UT on 25 September and ended at 1710 UT on 30 September 2001. These extremely high energetic protons accelerated during CMEs produces significant ionization in the D region of the ionosphere at high latitudes. Increase in ionization in the D region causes cosmic noise absorption. The major Polar Cap Absorption (PCA) observed during SEPTEMBER 24 -30, 2001 will be discussed in this paper. Imaging riometer observations were made from Kilpisjarvi (69.05^{o}N; 20.79^{o}W), Northern Finland during the PCA event. For this the remote and *insitu* data have been used. The imaging riometer for ionospheric studies (IRIS) is used to quantify the intensity, time of occurrence and location of CME effects on the ionosphere.

OI 630.0 nm Night Airglow Observations during the Geomagnetic Storm on November 20, 2003 at Kolhapur (P43)

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The ground based photometric observations of OI 630 nm emission line have been carried out from Kolhapur station (Geog. Lat.16.8˚N, Geo. Long 74.2˚E), India during the period of the largest geomagnetic storm of the solar cycle 23 which occurred on 20 November 2003, with minimum Dst index –472 nT occurring around mid-night hours. We observed that on 19 November 2003 which was geomagnetically quiet day, the airglow activity of OI 630 nm emission was subdued and it was decreasing monotonically. However, on the night of November 20, 2003 the enhancement is observed during geomagnetic storm due to the increased electron density at the altitude of the F region which is related to the downward transport of electron from the plasmasphere to the F-region. Airglow intensity at OI 630.0 nm showed increase around midnight on November 21, 2003 but comparatively on a smaller scale. On this night the DST index was about –100 nT. This implies that the effect of the geomagnetic storm persisted on that night also. These observations have been explained by the penetration magnetospheric electric field to the low latitude region and the subsequent modulation of meridional wind during the magnetic disturbance at night.

Studies of Sources on the Sun of Geo-effective Solar Events (P44)

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Source on the solar disc which causes the major solar proton events and large geomagnetic storms in the present solar cycle are studied in present paper. It is observed that all six major solar proton events studied were associated with CMEs that originated from West of East 30^o and between ±30^o Lat. on the solar disc. This is because Solar protons originating from western side of the solar disc follow the Archimedean spiral pattern of interplanetary magnetic fields and spiral down into the Earth's vicinity.

Nonlinear Processes in the Heliosphere and Their Effect on Spectral Index and Particle Energization (P45)

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The main objective of this talk would be to use the scientific data of various space missions (present and past related to IHY) and use them to understand the basic phenomenon that is responsible for transporting the energy of the sun (source) in the form of solar wind turbulence in the earth magnetosphere. What is the spectral index of this turbulence and on what parameters/factors it depends? With the help of computer simulated results, the evolution process will be illustrated in space and time in the heliospheric regions. In the second part of this talk, the coupling of this energy to the heliospheric particles and other nonlinear waves will be discussed. Specifically, the solar energetic particles generation and their energy distribution functions will be presented.

Newborn Coronal Holes Associated with the Disappearance of Polarity Reversal Boundaries (P46)

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Coronal holes play an important role in the occurrence of various kinds of solar events. The geomagnetic activity, coronal transients, type II radio bursts, and soft X – ray blowouts have shown their strong association with coronal holes (Webb et al., 1978; Shelke and Pande, 1985; Bhatnagar, 1996; Hewish and Bravo, 1986). Recently, Shelke (2006) has linked the onset of interplanetary erupting stream disturbances with the evolutionary changes in the coronal holes. The present study reveals that there exists some physical relationship between the formation of new coronal holes and the disappearance of polarity reversal boundaries with or without the overlying prominences. About 124 new coronal holes are found to emerge at the locations where polarity reversal boundaries existed prior to their disappearance. Among them, nearly 66% and 18% newborn coronal holes have been associated with disappearing prominences and disappearing small unipolar magnetic regions (UMRs) with encircled polarity reversal boundaries respectively. Coronal holes and quiescent prominences are stable solar features that last for many solar rotations. A coronal hole is indicative of a radial magnetic field of a predominant magnetic polarity at the photosphere, whereas solar prominence overlying the polarity reversal boundary straddles both the polarities of a bipolar magnetic region. The new coronal hole emerges on the Sun, owing to the changes in magnetic field configuration leading to the opening of closed magnetic structure into the corona. The mechanism that leads to the eruption of polarity reversal boundaries with or without prominences seems to be interlinked with the mechanism that converts bipolar magnetic regions into unipolar magnetic regions characterizing coronal holes. The fundamental activity for the onset of erupting polarity reversal boundary seems to be the opening of preexisting closed magnetic structures into a new coronal hole, which can support mass motion including erupting prominence.

A Possible Generation Mechanism of Whistler Precursors Observed at Low Latitude (P47)

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Whistler precursor is an interesting type of discrete VLF emissions, usually a rising tone, which is observed before the whistler with which it appears to be associated with. They are closely associated with a lightning discharge in the same hemisphere and with two-hop whistlers generated by the same sphere. In this paper, whistler precursors observed at low latitude ground station Gulmarg (geomag. Latitude 24^0 $10^/$ N, L=1.23) are explained. A possible generation mechanism based on parametric reflection of VLF whistler wave is proposed. In this process a reflected whistler wave arises when an intense whistler mode wave decays into quasi-electrostatic short-scale waves, one LHR wave and the other ion acoustic wave, through the process of parametric decay instability. Also reflection of whistler wave may arise during the interaction of natural whistler wave, with ion cyclotron or ion acoustic waves. The reflection mechanism is equivalent to backward transformation of the LHR and ionic waves into a whistler-mode wave. This leads to partial reflection of the initial ducted whistler whistler wave from an altitude where the whistler wave frequency coincides with the local lower hybrid resonance frequency. The reflected whistler wave is ducted along the same duct as the initial whistler wave, and propagates to the ground-based receivers from two points. Such a reflection will produce the precursors with a specific hook-like shape on a spectrogram. This mechanism explains most of the observed properties of the precursors well. We have also computed the growth rate of the wave and the electric field amplitude of ion cyclotron waves. These results are discussed in the light of recent published works.

A Case Study of PI-2 Pulsations Observed at Indian Antarctic Station Maitri (P48)

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Waves in ultra- low- frequency (ULF) band (periods of 1 to 1000s) are permanent feature in the region called the magnetosphere, where the behavior of charged particles is influenced by the Earth's intrinsic magnetic field. These waves transport momentum and energy from the solar wind to the magnetosphere and further down to the ionosphere. In addition, the waves interact with charged particles in the magnetosphere modify their energy and direction of motion with important consequences for dynamic processes such as geomagnetic storm and the formation of auroral arcs. In the present paper, we have analyzed one-second data recorded by fluxgate magnetometer with 0.1nT resolution observed at Indian Antarctic station, Maitri (geom. lat. 62^0S, geom. long. 57.23^0E, L=4.5). We have studied the various characteristic features of Pi-2 pulsations (10 MHz) observed on October 1, 2003 during 08-12 UT. The detailed results will be presented during the workshop.

Spatial Damping of Magneto-acoustic Waves in Quiescent Prominences by Newtonian Cooling (P49)

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Solar prominences owe their importance in the solar physics due to their formation in the hot million degree corona, long term stability and eventual eruption in the form of Coronal Mass Ejections (CMEs) that play an important role in the space weather and solar-terrestrial relations. Oscillations in prominences have been known for a long time and these have been interpreted in terms of the linear MHD waves. The typical features of damped oscillatory motions in prominences are still unexplained. We here report the results on the effects of radiative losses due to Newtonian cooling that have been considered to examine for the spatial damping of magnetoacoustic waves in quiescent prominences. The radiative losses give acceptable damping lengths for the slow mode wave for relaxation times in the range (10-10^3s). The fast mode waves damp over a larger distance. From prominence seismology, the values of opacity have been inferred. It has been found that for a given value of radiative relaxation time, the high frequency slow mode waves are highly damped. The damping length has been found to be of the order of 10^3 -10^4 km for the slow mode waves with the period of oscillations between 5 and 46 min.

Damping of MHD Waves in Quiescent Prominences (P50)

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The effects of radiative losses due to Newtonian cooling and MHD turbulence have been considered to examine the damping of linear MHD waves in unbounded quiescent prominences. Taking account of isotropic viscosity in the momentum equation and viscous as well as radiation terms in energy equation, we derive a general fifth-order dispersion relation. The analytical solutions of the general dispersion relation have been obtained. It is shown that the damping of magnetoacoustic waves depends on the equilibrium density, magnetic field, temperature, frequency and wave number. The fifth-order general dispersion relation has been solved numerically. We have compared our results with the observations taken from the VTT telescope at Sac Peak. We find that the slow mode waves are mainly affected by radiation but fast mode waves remain unaffected, while noting that both of them are damped due to MHD turbulence. We also find that classical viscosity hardly plays a role in damping the magnetoacoustic waves. The radiative losses give acceptable damping lengths for the slow mode waves for the radiative relaxation times in the range 10 - 10^3 s. It has been found that for a given value of radiative relaxation time, the high frequency slow mode waves are highly damped. We have also investigated the possible role of MHD turbulence in damping of MHD waves and found that a turbulent viscosity can re-produce the observed damping time and damping length in prominences, especially in PCTR. We find that MHD turbulence alone can explain the damping of magnetoacoustic waves in prominences. From prominence seismology, the values of opacity and turbulent kinematic viscosity have been inferred.

Study of Ionosphere-Magnetosphere Coupling Using Whistler Data (P51)

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The VLF waves observed at the ground stations are used for probing the ionosphere/magnetosphere parameters. The probing principle depends on the analysis of dispersion produced in the whistler mode waves during their propagation from the source to the observation point. Dispersion depends on the distribution of plasma particles and ambient magnetic field along the path of propagation. Specifically, we derive the information about the equatorial electron density, total electron content in a flux tube, equatorial east-west electric field, transport of electron flux from one region to the other, electron temperature etc. The transport of flux and electric fields are essentially involved in the study of coupling of the ionosphere and magnetosphere. In the present paper, we shall report the analysis of whistler data recorded at Varanasi and Jammu. The analysis shows that the analyzed whistlers from both the stations belong to mid-high latitudes contrary to the belief that they were low latitude phenomena. Further, there is no correspondence between the dispersion and derived L-value for the path of propagation. This leads to the requirement of detailed study of VLF wave propagation in the inhomogeneous ionosphere-magnetosphere system. The electron density and the total electron content in a flux tube derived from whistler measurements at Varanasi and Jammu are approximately one order of magnitude smaller than the previously reported data from the whistler measurements at mid-high latitudes. However, their variation with L-value has the same nature. The time development of the content of flux is evaluated which could easily explain the reported flux transport during the study of coupling of ionosphere to the magnetosphere. We have also evaluated electric field, which compares well with the previously reported value. These results clearly indicate that the VLF wave propagation at low latitude and their diagnostic properties require much more attention both from the point of view of data collection and theoretical formulation. Efforts should be made in this direction to study the latitudinal/ longitudinal distribution of electron density and its long-term variations using a network of stations equipped with identical equipments spread over a range of latitudes and longitudes. The collected data will be useful in the study of coupling of ionosphere and magnetosphere.

Geomagnetic Pulsations as Observed from Ground-Based Searchcoil Magnetometers (P52)

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Magnetometer data from Searchcoil magnetometers in the Indian sectors have been analyzed to study geomagnetic pulsations in the low latitude region. On April 01 2005, we observe Pc 4 events at ~ 19 UT in the frequency range 10-15 mHz. The oscillations are seen in all the components (H, D, Z) indicating thereby that oscillations are compressional in nature. These pulsations are very much on the line of expectations at these latitudes. Apart from these normal pulsations, we observe the presence of pearl-type oscillations (~ 4 Hz) which is very unlikely at these latitude. These waves are common features of high latitude regions. The interesting aspect of these observed pearl-type features is that they follow a spike of broad-band source as revealed by the dynamic spectra. We are examining the role of thunderstorm lightening in generating these pearl-type pulses. Schumann resonances serve as indicators of lightning phenomena and we use their occurrences as parameter for lightening for correlating observed pulses to spiky broadband features preceding these pulses.

Observation of Height Variation of Tropical Tropopause with Sunspot Number (P53)

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A study has been undertaken to investigate the possible relation between height of the tropical tropopause and sunspot number using observations with Indian MST radar at Gadanki (13.47°N, 79.1°E). We have found anti-correlation between the height of the tropical tropopause and sunspot number. This anti-correlation between the tropopause height and sunspot number has been further confirmed by the nearest radiosonde observing station of India Meteorology Department at Chennai (13.04^0N, 80.14^0E).

Fast Solar Wind from Slowly Expanding Magnetic Flux Tubes (P54)

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We present an empirical model of the fast solar wind, emanating from radially oriented slowly expanding magnetic flux tubes. We consider a single-fluid, steady state model in which the flow is driven by thermal and non-thermal pressure gradients. We apply a non-Alfvénic energy correction at the coronal base and find that specific relations correlate solar wind speed and non-thermal energy flux with the aerial expansion factor. The results are compared with the previously reported ones.

FE-XIII Infrared / FE-XIV Green Line Ratio Diagnostics (P55)

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We consider the first 27-level atomic model of Fe XIII ($5.9 < \log T_e < 6.4$ K) to estimate its ground level populations, taking account of electron as well as proton collisional excitations and de-excitations, radiative cascades, radiative excitations and de-excitations. Radiative cascade is important but the effect of dilution factor is negligible at higher electron densities. The $^3P_1$-$^3P_0$ and $^3P_2$-$^3P_1$ transitions in the ground configuration $3s^2\ 3p^2$ of Fe XIII result in two forbidden coronal emission lines in the infrared region, namely 10747 Å and 10798 Å., while the 5303 Å green line is formed in the $3s^2\ 3p$ ground configuration of Fe XIV as a result of $^2P_{3/2}$ - $^2P_{1/2}$ magnetic dipole transition. The line-widths of appropriate pair of forbidden coronal emission lines observed simultaneously can be useful diagnostic tool to deduce temperature and non-thermal velocity in the large scale coronal structures using intensity ratios of the lines as the temperature signature, instead of assuming ion temperature to be equal to the electron temperature. Since the line intensity ratios $I_{G5303}/I_{IR10747}$ and $I_{G5303}/I_{IR10798}$ have very week density dependence, they are ideal monitors of temperature mapping in the solar corona.

Satellite Measured Electron Intensities during Intense Magnetic Storm at Equatorial Anomaly Region over Indian Sector

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The GPS data obtained from IGS data base corresponding to the quiet and disturbed period of the ionosphere at Equatorial anomaly region in the Indian sector (IISC and HYDE) have shown a remarkable increase in total electron content during storm time on 29th Oct 2003 (A_p= 400, during main phase). The analysis extended for the other regions around the anomaly region (IISC, HYDE, YIBL, KUNM, BAHR and POL2) have revealed similar enhancements during such period. The locations include the crest of the anomaly region to the trough in the Indian longitude as well as extended in east and west of the temperate latitude. The ground-based magnetometer corresponding to the equatorward edge of anomaly region has shown an exceptional agreement in time of IMF, H-field and D_{st} reversals with the time of the estimated peak TEC. Nevertheless the time of H-field's reversal maximum seems to subtly delay about a few minutes due to the longitudinal differences with respect to IST. The electron intensity during disturbed time is shown to increase by 46.5% that of the quiet time values measured at anomaly crest region at the reversal time of D_{st}. The magnetic field reversal with the corresponding reversal of IMF coinciding with peak value of TEC confirms that the electric field penetrations at low latitude region are an instantaneous process. The latitudinal changes of TEC are shown to decrease from crest region to trough much more steeply on quiet times compared to the storm time.

Simultaneous Amplitudes of ULF Pulsation Measured at Low, Middle, and Subauroral Latitudes during an Intense Magnetic Storm (P57)

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The storm time magnetic field analyzed for its respective Fourier components are shown to have intense pulsations at Pc6 wave modes than any other. This storm occurred on 29th Oct 2003 and it is known to be one of the intense storms in the last solar cycle. The analysis was supplemented with the solar wind parameters obtained by the ACE satellite. IMAGE satellite data on auroral intensity during this time are shown to have considerable changes in its intensity. The analysis in particular has revealed the relative intensities of Pc waves for all of its frequency ranges which include Pc6 viz, the Substrom pulsations. The comparison of amplitudes for these pulsations found at subauroral latitude with the middle and low latitude stations have shown to reveal that the pulsations are predominantly a high latitude phenomenon. The disturbance time scales at much longer time scales are rather found to relate to the changes in electric field in the ionosphere during such period.

Study of Historical 4B/X17 Mega Flare on 28 October 2003 (P58)

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We analysed multi-wavelength data of 28 October 2003 4B/X17.2 class extremely energetic parallel ribbon solar flare, which occurred in NOAA 10486. The flare was well observed in H-alpha at ARIES, Nainital and various space (SOHO, TRACE, RHESSI, WIND etc.) and ground based Observatories. The H-alpha observations show the stretching/detwisting and eruption of helically twisted S shaped (sigmoid) filament in the South-West direction of the active region with bright shock front followed by rapid increase in intensity and area of the gigantic flare. The flare is associated with a bright/fast full halo earth directed CME, strong type II, III and IV radio bursts, an intense proton event and GLE. It seems that the filament eruption triggered the halo CME because the helical structure is clearly visible in the SOHO/LASCO C2, C3 images. This indicates helicity transfer from chromosphere to corona and interplanetary medium. The magnetic field of the flaring region was most complex with high magnetic shear. From the above analysis we feel that the energy buildup/release process of this unique flare support helically twisted magnetic flux rope model.

Troposphere - Ionosphere Interaction at Equatorial Latitude, Tirunelveli, India (P59)

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We have made an attempt to study the troposphere - ionosphere interaction at equatorial latitude station. The tropospheric variability has been studied by using surface pressure variation. The stratospheric variability has been studied by using ozone variability from the TOMS satellite. The mesopause temperature has been measured by Tiwari et al. (2002) and has been used in the present study. The magnetic activity index (aa-index) has been used as an input variability from the solar atmosphere. The gravity wave amplitude shows increasing trend from winter to summer season. The ozone column density shows decreasing trend from winter to summer of 2001. The tropospheric gravity wave amplitude found to be in similar phase to the mesopause temperature with a time lag of about 7 days. The aa-index shows some similarity with the tropospheric gravity wave amplitude at the time lag of about 15 days. The stratospheric – mesospheric – and thermospheric parameter shows the prominent presence of planetary waves of period 25 days, 14 days, 7 days etc. On the other hand, tropospheric power spectrum shows the presence of 27 days, 16 days, and 9 days etc. The tropospheric power spectral peak shows a time lag of two days with upper atmosphere power spectral peaks. This study shows that the disturbances takes about 15 days to reach from thermosphere to tropospheric altitude, and it takes about 7 days from the mesospheric to tropospheric altitude. Thus there might be a movement of disturbances from thermosphere to troposphere and the time lag is found to be varying from one to two week period.

Study of Ozone Variability at Equatorial Latitude during Severe Geomagnetic Storm (P60)

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We have made an attempt to study the influence of geomagnetic storm on the total ozone variability at Indian equatorial latitude. TOMS (Total Ozone Mapping Spectrometer) and Meteor –3 satellite has provided the long duration ozone variability from polar to equatorial latitude region. In the present study we have considered only severe and strong geomagnetic storm conditions. Some of the recent geomagnetic storm considered in the present study is Oct 2003, November 2004, April 2001, April 2000, November 2000, October 1999, September 1998, May 1998, and October 1997. Lastovicka et al (1992) initiated investigations of geomagnetic storm effects on the total ozone and found that previous results obtained by various authors on effect of geomagnetic storms on the total ozone differed substantially. Further investigation shows that the geomagnetic storm effect on the total ozone have significant effect only under very limited conditions. We have studied the influence of geomagnetic storm on the total ozone at polar and Indian latitude stations. The polar latitude (Antarctic region) shows the increase in the total ozone content during the onset of magnetic storm. The total ozone at equatorial latitude shows an increase in onset day of magnetic storm, as well as, the increase in total ozone has been found after 10 days interval in most of the observations. Some of the observations also show the enhancement at the interval of 5 and 15 days, after the onset of magnetic storm. We are also studying the ozone variability at different Indian stations, during the onset of magnetic storm. It is believed that the magnetic storm influences the earth's ionosphere at polar latitude and the disturbances produced at polar latitude propagate towards the equatorial latitude and might be affecting the equatorial ozone. The solar flare may be another important event responsible for the changes in ozone variability. The detailed results will be presented during the symposium.

Space Weather Activities at SERC for IHY: (1) Local Education, (2) Global Outreach and (3) Data Base Service (P61)

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The Space Environment Research Center (SERC), Kyushu University (KU), conducts everyday space weather "now casting". There are two main goals in this effort: (1) to train and educate KU students about the complexities of the Sun-Earth system so that they can become space weather forecasters in the future, (2) to globally disseminate space weather information from SERC as a service to the scientific community and the general public.

In order to understand the complexities of the Sun-Earth system, KU students analyze the data of four regions: (1) solar surface, (2) solar wind, (3) geospace, and (4) the Earth's surface. Using real-time public data from SOHO Real Time Movies, Solar Monitor, NASA/GSFC/SDAC, and SEC's Anonymous FTP Server, they check each day the Sun Spot Number, locations of active regions and coronal holes, and identify solar flare events: GOES X-Ray Flux, CME: SOHO/ LASCO-C2, 3, and Proton Event: GOES Proton Flux. By analyzing ACE Real Time Data, KU students examine the solar wind (Speed, Density, Temperature) and Interplanetary Magnetic Field (IMF: Bt, Bz, Phi), and identify events of sector boundary, CIR, CME, and Shock/Discontinuity. To understand magnetic circumstances in geospace and on the Earth's Surface, KU students analyze storms and substorms using Dst index (Kyoto Univ.), Kp index (NOAA), and Magnetic Pulsation Index (Pc 3, 4, and 5: SERC). Every morning KU students create a space weather report and then discuss it with the staff at SERC for local training and education. The report and its details are disseminated on the SERC Home Page (http://www.serc.kyushu-u.ac.jp) to provide "global outreach" for space weather information. MAGDAS (Magnetic Data Acquisition System) data are obtained from the Circum-pan Pacific Magnetometer Network (CPMN) locations during the IHY period (2007-2008). MAGDAS magnetometers are installed at 50 stations along the 210^{o} magnetic meridian and the magnetic dip equator, which includes East Asia, the Pacific Islands, South America and Africa. MAGDAS data is made up of three components of the magnetic variations (H, D, Z) with 1-second and 1-minute sampling rate. After data correction at SERC, authorized MAGDAS collaborators can access the SERC server, in which the corrected data are stored, and get 1-min and 1-sec digital data. The MAGDAS data can be provided for all the scientific purposes through the Internet. SERC will offer the MAGDAS database to the scientific community for collaborative work.

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