The 4th Balkans, Black Sea and Caspian Sea Regional Network on Space Weather Studies (BBC SWS) International Conference

SOLAR AND HELIOSPHERIC INFLUENCES ON THE GEOSPACE

Bucharest, ROMANIA, 1 – 5 October 2012

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Table of Contents

SCIENTIFIC PROGRAM

Monday, 1 October

09:00−10:00 − Participant Registration
10:00−10:30 – Opening Session

10:30−11:00 − Coffee Break and Poster viewing

Session 8 – Education, Dissemination, Outreach

11:00-12:00 – Ilia Roussev: Heliophysics: Anatomy of Solar Anger (invited lecture)
12:00-13:00 – Petra Vanlommel: Where communication and space weather meet (invited lecture)

13:00–14:30 − Lunch

14:30 – 15:30 – Remus Hanea: Data Assimilation and its applications (invited lecture)
15:30 – 15:45 – Elena Moise: Hawai'i Center for Advancing $istemic Heliophysics Education (HI CA$HEd)

16:00−16:30 − Coffee Break and Poster viewing

16:30 – 17:30 – Ingolf Dammasch: Space weather data and services at ROB/SIDC (invited lecture)
17:30 – 18:30 – Elena Moise: Interstellar Neutral Atoms and Their Journey through the Heliosphere (invited lecture)

19:00 − Welcome Cocktail at „Petőfi Sándor“ Hungarian Cultural Centre

Tuesday, 2 October

Session 1: Solar magnetism as driver of the short- and long-term solar variability

9:30 – 10:00 – Marina Gigolashvili: Comparative Analysis of Variations of the Solar Spectral Irradiance in Connection to Solar Activity Cycles and Solar Magnetism (invited talk)
10:00 – 10:15 – Darejan Japaridze: Study of variations of rotation rates of Hα filaments and compact magnetic features at the moment of polarity reversal of solar magnetic field
10:15 – 10:45 – Katya Georgieva: Solar dynamo theory – recent progress, questions and answers (invited talk)

10:45 – 11:00 – Mircea Rusu: The asymmetry of the solar cycle: Analysis of the cycle #24 forecast

11:00−11:30 − Coffee Break and Poster viewing

Session 3: High-energetic solar events (Flares, CMEs, SEPs)

11:30 – 12:00 – Ingolf Dammasch: Observation of flares with LYRA on PROBA2 (invited talk)
12:00 – 12:15 – Diana Besliu-Ionescu: Sunquakes and Moreton waves
12:15 – 12:30 – Atila Özgüç: Effects of Hysteresis between Maximum CME Speed Index and Geomagnetic

12:30–14:00 – Lunch

14:00 – 14:30 – Alessandro Bemporad: Observations of solar storms in the outer corona (invited talk)
14:30– 15:00 – Ilia Roussev: Global MHD Modeling of CMEs and Related Shock Waves Originating from Complex Active Regions (invited talk)

15:00−15:30 − Coffee Break and Poster viewing

15:30 – 16:30 – Diana Beşliu-Ionescu: Seismic Emission from Solar Flares (invited lecture)
16:30– 16:45 – Olga Malandraki: COMESEP Project: Space Weather Impact forecasting

Wednesday, 3 October

One day round trip – Bucharest surroundings

Thursday, 4 October

Session 2: Solar wind: sources and structures

9:30 – 10:15 – Marilena Mierla: Slow solar wind (invited lecture)
10:15 – 10:30 – Georgeta Maris Muntean: Specific features of the high-speed streams in the solar wind and geomagnetic storms during the last prolonged solar minimum

10:30−11:00 − Coffee Break and Poster viewing

Session 4: Heliosphere: its magnetic structure, ICMEs, Cosmic Rays

11:00−11:30 – Olga Malandraki: Heliophysical research in Greece: the space weather perspective (invited talk);

11:30−11:45 – Natela Kapanadze: Solar Spectral Irradiance Variability and its Possible Connection with the Cosmic Rays during the Decreasing Phases of the Solar Activity Cycle 23
11:45− 12:00 – Marilena Mierla: Empirical model for predicting the occurrence of major geomagnetic storms during SC23

12:00–14:30 − Lunch

Session 5: Magnetosphere variability under the solar & heliospheric forcing

14:30−15:00 – Crisan Demetrescu: On the climate of the solar-terrestrial space (invited talk)
15:00−15:15 – Oana Stere: The study of coronal mass ejections travel time to the Earth
15:15 – 15:30 – Constantin Oprea: Study of solar parameters causing major ceomagnetic storms during SC 23

15:30−16:00 − Coffee Break and Poster viewing

FREE AFTERNOON

19:00 – Closing Dinner at Bistro Jaristea (Address: 5 Henri Coanda St., corner with Dacia Bvd.).

Friday, 5 October

Session 6 & Session 7
Ionosphere and its induced disturbances
Middle and lower atmosphere long-term variability / Climate change

9:30−10:30 – Mirela Voiculescu: Ionospheric perturbations induced by interplanetary and solar forcing (invited lecture)
10:30−11:00 – Katya Georgieva: Solar influences on climate (invited talk)

11:00−11:30 − Coffee Break and Poster viewing

11:30–12:00 – Venera Dobrica: Long term solar and geomagnetic activity. Consequences on the terrestrial climate at regional scale (invited talk)
12:00- 12:30 – Marilena Mierla: Conference Summary

12:30–14:00 − Lunch

HIGH SPEED SOLAR WIND STREAM INFLUENCE ON THE MAGNETOSPHERE OF THE EARTH

Simeon Asenovski, Yana Asenovska

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When high speed solar wind streams reach the Earth's magnetosphere, they may cause essential physical processes on it. They are not associated with large geomagnetic storms which are usually caused by CME but nevertheless high speed solar wind streams are important drivers of the geomagnetic activity. In the present work we study some main manifestation of the high speed solar wind streams on the Earth's atmosphere.

OBSERVATIONS OF SOLAR STORMS IN THE OUTER CORONA

Alessandro Bemporad

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Over the last 15 years continuous monitoring of the Sun provided by the space based observatories gave us a new view of solar storms (or Coronal Mass Ejections - CMEs), the main drivers (together with the solar wind and solar energetic particles – SEPs) of geomagnetic storms on our planet. The development of CMEs in the outer corona has been studied with radio antennas, white light coronagraphs and UV/EUV spectrometers. UV spectra sampled during solar eruptions allowed us to study their 3D expansion velocities, their thermal energies, to characterize CME-driven shocks, to study the evolution of post-CME current sheets and small scale eruptions (like narrow CMEs, polar jets, streamer puffs). At the same time, coronagraphic white light images and radio dynamic spectra provided estimates of the CME kinetic energies, masses and densities, information on CME-driven shocks and on the acceleration and propagation of Solar Energetic Particles (SEPs) during flares/CMEs. This talk will be aimed at reviewing these results and discussing problems on the CME origin, energetic and evolution unsolved so far.

SUNQUAKES AND MORET ON WAVES

Diana Besliu-Ionescu[1,2] , Marilena Mierla[1,3,4], Georgeta Maris Muntean[1]

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Some solar flares can release acoustic transients into the solar subsurface of the active regions that host them. Most of the acoustic power in these transients propagates something like 10-30 Mm beneath the photosphere before it is refracted back to the surface, where it raises a significant disturbance. In the strongest of these "sunquakes", the manifestation of this transient in helioseismic movies is an outwardly expanding surface ripple that becomes conspicuous about 20 minutes after the impulsive phase of the flare. Sunquakes offer a powerful diagnostic of wave propagation in the active region photosphere and of the structure and dynamics of the subphotosphere. Several flares seismically active have Moreton waves associated concomitant with the fast rising ascending phase.
We will show and discuss the associated Moreton Waves as well as possible connection in between these emissions.

ASSESSING THE RELATIONSHIP BETWEEN CLOUDS AND THE INTERPLANETARY MAGNETIC FIELD

Simona Condurache-Bota, Mirela Voiculescu
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Climate changes problem must imply the study of the cloud cover variability, since clouds are essential for the terrestrial radiation budget. Equally or even more important is to assess the causes of climate changes, subject which already reached even a political level debate, as it is disputed whether the anthropogenic activities are mainly responsible, in the context of aggressive global industrialization and its implied pollution. Still, the scientists cannot ignore the fact that solar activity and the interplanetary magnetic field (IMF) suffered changes during the period for which measurements are available. Since the Sun is essential for the terrestrial climate and also because the IMF changes could influence cloud at microphysical level, the connection between cloud cover and the IMF seems logical to be studied. And because the mechanisms of cloud formation change with altitude, the particularization of IMF connection with clouds from different altitudes is a useful type of study, which is what this paper proposes. Clouds cover data from ISCCP and the IMF data from NASA's Omniweb site, for the time span between 1984 and 2009 are used for analysis. The implication of local phenomena influencing the searched correlations is also considered.

OBSERVATION OF FLARES WITH LYRA ON PROBA2

Ingolf Dammasch

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Evaluating the solar impact on the Earth's climate requires knowledge of variations in Solar Spectral Irradiance. LYRA is a solar ultraviolet radiometer onboard ESA's PROBA2 mission. The instrument acquires solar irradiance in four broad spectral intervals, from soft X-ray to UV, that have been chosen for their relevance in solar physics, space weather, and aeronomy. Analysis of LYRA time series of flares showed that the flare rise phase is dominated by soft X-ray, whereas the flare decline phase takes longer than this and seems to be dominated by cooler EUV emission. Using data monitored by GOES and SDO/EVE, we will try to understand the quantitative relationship of these spectral intervals.

ON THE CLIMATE OF THE SOLAR-TERRESTRIAL SPACE

Crisan Demetrescu, Venera Dobrica, Georgeta Maris Muntean

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The solar-terrestrial space is characterized both by space weather and by space climate variability. The so-called space climate concerns the long-term change in the Sun and its effects in the heliosphere and upon the Earth, including the atmosphere and climate. This study focuses on the characterization of space climate at timescales of the Hale and Gleissberg solar cycles based on annual means of measured and reconstructed solar, heliospheric, and magnetospheric parameters. Available open solar flux, modulation strength, cosmic ray flux, total solar irradiance data, reconstructed back to 1700, solar wind parameters (speed, density, dynamic pressure) and the magnitude of the heliospheric magnetic field at 1 AU, reconstructed back to 1870, as well as the time series of geomagnetic activity indices (aa, IDV, IHV), going back to 1870, have been considered. Also, shorter time series of some other geomagnetic indices, designed as proxies for specific current systems, such as the ring current and the auroral electrojet, that develop in the magnetosphere and ionosphere as a consequence of the interaction with the solar wind and heliosperic magnetic field (the Dst and, respectively, AE indices), as well as the merging electric field and convection in the polar ionosphere (the PC index) have been taken into account. Simple filtering procedures (successive 11-, 22-, and 88-year running averages and differences between them) and scaling by the standard deviation from the average value for the common interval covered by the data show that the long-discussed variation in the 20th century (a pronounced increase since ~1900, followed by a depression in the '60s and a new, slower, increase), seen in the 11-year averages of parameters such as geomagnetic activity indices and reconstructed heliospheric magnetic field strength, solar wind speed, open solar flux etc., is a result of the superposition in data of solar activity signatures at Hale and Gleissberg cycles timescales. The Hale and Gleissberg signals were characterized and similarities and differences in the temporal behavior of the analyzed parameters at these timescales are discussed. The similarities in the studied parameters point to the common pacing source, the solar dynamo.

SPACE WEATHER DATA AND SERVICES AT ROB/SIDC

Ingolf Dammasch

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I will give an introduction to the Solar Influences Data Analysis Center of the Royal Observatory of Belgium and describe various inputs for space weather analysis and forecast, as there are: the sunspot index, ground-based solar images, the PROBA2 science center, the SDO data center, CME monitoring, and radio observations.

LONG TERM SOLAR AND GEOMAGNETIC ACTIVITY. CONSEQUENCES ON THE TERRESTRIAL CLIMATE AT REGIONAL SCALE

Venera Dobrica, Crisan Demetrescu, Cristiana Stefan

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Our previous studies regarding the long-term solar and geomagnetic activity revealed that in terms of 11-year running averages there is a long-term similarity between the solar activity, as described by the sunspot number, and the geomagnetic activity, as described by several geomagnetic indices. We showed that the variation depicted by 11-year running averages of studied parameters resulted from the superposition of Hale and Gleissberg cycles signatures in the corresponding time series. It is well known that the relationship between the solar variability and geomagnetic activity is far better understood than the possible causal links with climate of either solar or geomagnetic variabilities. Such links and the relative contribution of either solar or geomagnetic effects on climate, as well as the associated physical processes are still a matter of debate. Solar/geomagnetic variability as external natural forcing on terrestrial climate is investigated in this study, by means of long-term statistical correlations between climatic parameters and solar/geomagnetic indices at local and regional scales. A robust and reliable data set of long records of air temperature for Europe (24 stations, 1900-2006), as well as for the Romanian territory (14 stations, 1850-2004), is available. We analyze these records in connection with long-term trends in solar and geomagnetic activities. The time series were filtered by means of 11- and 22-year running averages and the corresponding variations were compared to solar/geomagnetic variability. Strong and coherent solar signals have been found at Schwabe and Hale solar cycles timescales.

SEISMIC EMISSION FROM SOLAR FLARES

Alina Donea[2], Diana Besliu-Ionescu[1,2]

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In 1998, the first solar quake has been discovered just at the beginning of the solar cycle 23 by Kosovichev and Zharkova (1998). This discovery produced a sensation at the time. Multiple questions arisen: What were the possible seismic sources triggering such powerful events? How are they generated? How big are they?

Helioseismology has proven to be one of the most exact sciences, where theory and observations agree very well, and an exceptional tool for precisely studying the Sun's interior. The normal modes of oscillation of the Sun can be categorized as either p-modes, f- modes, or g-modes. Each mode is characterized by its spherical harmonic degree, (which is approximately the number of wavelengths around the solar circumference), and the radial order, n (the number of nodes in the radial direction). The g- (or "gravity") modes are internal gravity waves for which the primary restoring force is buoyancy, and are almost totally confined to the deep solar interior. The f- (or "fundamental") mode (n = 0) is an incompressive, surface gravity wave with amplitude that decays roughly exponentially with depth away from the solar surface. The p- (or "pressure") modes are gravity-modified acoustic waves, with the pressure being the primary restoring force.

Further sun quakes were detected in 2003, when two major solar flares triggered a multiple source acoustic event on the solar photosphere (Donea and Lindsey, 2005). Most recently, solar quakes have been detected also in the new solar cycle 24. At present, solar oscillations are detected by the Global Oscillation Network Group (GONG+), HMI-SDO (Scherrer et al., 2009) and HINODE (SOLAR-B) (Kosugi et al., 2007). This lecture will present introductory notions about solar oscillations and focus on techniques to detect seismic emissions from solar flares.

SOLAR INFLUENCES ON CLIMATE

Katya Georgieva

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The Sun is the biggest energy source in the vicinity of the Earth, so it affects the terrestrial system in a number of ways. The idea of solar activity influences on climate was suggested more than 200 years ago, even before the discovery of the solar cyclicity. In the centuries to follow, lots of studies were performed demonstrating well expressed correlations on different time-scales between solar activity parameters and various meteorological elements like air and sea surface temperature, precipitation, cloudiness, pressure, circulation patterns, etc. Still, the question of whether and to what extend solar variability is responsible for the observed climate changes remains controversial, mainly because there is no generally accepted physical mechanism explaining the solar influences on climate. In this talk I will summarize the known solar effects on climate, and will review the proposed mechanisms linking different manifestations of solar activity with the observed effects on the atmosphere.

SOLAR DYNAMO THEORY – RECENT PROGRESS, QUESTIONS AND ANSWERS

Katya Georgieva, Boian Kirov

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Much progress has been recently made in the development of the solar dynamo theory, and cycle 24 is the first cycle for which predictions have been made based on theory rather than only statistics and/or precursors. However, there are still many open questions like the values and variations of the basic dynamo parameters, the regime of operation of the dynamo in the different parts of the solar convection zone, the driving sources of long-term variations and irregularities in solar activity in general and the appearance of grand minima in particular. Here we use long-term reconstructions of solar dynamo parameters to verify the theory and to address the above questions.

COMPARATIVE ANALYSIS OF VARIATIONS OF THE SOLAR SPECTRAL IRRADIANCE IN CONNECTION TO SOLAR ACTIVITY CYCLES AND SOLAR MAGNETISM

Marina Gigolashvili

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The results of investigation of the time structure of the solar spectral irradiance (SSI) with special attention to selected spectral lines emission, which are identified with ionized chemical elements are presented. Statistical analysis on data of solar spectral irradiance was carried out during 1981-2008, using the data from the Solar Irradiance Datacenter's websites. We have investigated the SSI data of chemical elements in the range of 120-300 nm for the solar cycles 21, 22 and 23, based on spectral time series of solar UV irradiance measurements obtained by the Solar Mesosphere Explorer (SME, UARS, SORCE) experiments.

The international sunspot number data and total solar irradiance data are used as well. ISN data are obtained from the Solar Influences Data Analysis Center (SIDC), World Data Center for the Sunspot Index, at the Royal Observatory of Belgium. TSI data products are formulated using measurements made by the Active Cavity Radiometer Irradiance Monitor (ACRIM) experiments providing ongoing calibrated high precision values. We have developed software for extracting and processing of narrow bands spectral irradiance data for selected spectral lines, using the software developed on the base of the latest version of MATLAB.

It is found that variability of emission of selected solar spectral lines clearly repeats the main trends of sunspot number, TSI and the solar magnetic field strength for solar activity cycles 21, 22 and increasing phase of 23. However, one of the selected spectral lines emissions in UV range indicates opposite behavior. We found that anti-correlation takes place between intensities of this solar emission line and ISN and TSI for the decreasing phase of the cycle 23. Furthermore, we have found anti-correlation between solar sunspot numbers and visual range intensity of solar spectrum near to Ca II K 393.36 nm and He I 587.59 nm belonged to chromospheric emission.

SOURCES OF GEOMAGNETIC ACTIVITY AT LOCAL SCALE. CASE STUDY – EUROPEAN OBSERVATORIES

Razvan Greculeasa, Venera Dobrica, Crisan Demetrescu

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The geomagnetic activity is a result of the interaction of the magnetosphere-ionosphere system with the solar wind and with the heliospheric magnetic field. It is described by means of geomagnetic indices, specifically designed as proxies for several current systems that form in that environment, such as Dst, for the magnetospheric ring current, and AE, for the ionospheric auroral electrojet, or reflecting the general disturbed behaviour of the geomagnetic field at midlatitude (the aa index) or at planetary (Kp, Ap) scales. The present paper investigates the contribution of the ring current and auroral electrojet variabilities to the geomagnetic activity as recorded by 31 European observatories in the time interval 1-10.08.2010, chosen as to include the moderate (Dst min = - 70 nT) geomagnetic storm of August 3-4, with its recovery phase spanning to the 10th of August, and a few undisturbed days before the storm. To obtain the disturbed field from the recorded time series of minute values, at each observatory a mean diurnal solar quiet variation, inferred from the recordings in the five quietest days of the month, has been subtracted. Then, the disturbed variation was correlated with a linear combination of Dst and AE geomagnetic indices for the same time interval. The results show, as one might expect from the geometry of the two current systems, the decreasing influence of the ring current and of the increasing influence of the auroral electrojet from low to high latitudes. A complex behavior is seen in case of observatories north of 60 N.

SOLAR MAGNETIC FIELD AND GEOMAGNETIC ACTIVITY

Boian Kirov[1], Katya Georgieva[1], Georgeta Maris Muntean[2], Crisan Demetrescu[2], Venera Dobrica[2]

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It is well known that geomagnetic activity is the result of the action of various solar agents. The most important ones are the coronal mass ejections related to the solar toroidal magnetic field, and high speed solar wind related to the solar poloidal field.

The present study is devoted to the evolution of the toroidal and poloidal magnetic field of the Sun and its influence on geomagnetic activity.

DATA ASSIMILATION AND ITS APPLICATIONS

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The time behavior of large classes of engineering processes can be described by the dynamics of the solutions to a system of difference and/or differential equations. The theory of the later ones has undoubtedly been the subject of extensive research in modern mathematics. Regardless weather they are linear or not, these systems of equations are characterized implicitly or explicitly by a set of parameters. For many engineering applications (especially computer simulated behavior of processes) knowing useful and realistic values of these parameters is essential.

The most appealing approach to simulate the time behavior of a dynamical process is clearly provided by the use of linear system theory. However, this approach suffers from a lack of realism. In practical relevant cases the global process behavior can be severely nonlinear, leaving the engineer with the only feasible method of coping with a set of trimmed (linearized) dynamical systems. There are several inherent drawbacks associated with this linearization process. First, the parameters of the linearized model can lose an essential attribute: the physical meaningless. Second, the numerical values of these parameters are affected by round-off errors. Last, their true values can be unknown at the moment when the designer will like to make a decision influencing the behavior of the process in question.

In this model based approach to process behavior analysis even the most advanced analysis concepts such as input-state-output description cannot circumvent the above depicted obstacles. Although they provide an enhanced set of process information and methods for solving the parameter estimation problem, the results obtained by applying input - output measurement based techniques suffer from the following: sampling and representation errors, instrumental noise and indirect measurements.

There have been many attempts made during the last decades for developing advanced methodologies for solving this problem. Among them data assimilation has scored unexpectedly high at least as what concerns the quality of the results obtained while solving intricate engineering problems in the fields of: meteorology, atmospheric sciences, chemical engineering, reservoir engineering and geosciences.

Data assimilation is aiming at defining an as large as possible family of structured information sources about the dynamic process in question and formulating the state and parameter estimation problem as an optimization problem subjected to the constrains induced by the above structured family of information.

STUDY OF VARIATIONS OF ROTATION RATES OF Hα FILAMENTS AND COMPACT MAGNETIC FEATURES AT THE MOMENT OF POLARITY REVERSAL OF SOLAR MAGNETIC FIELD

Darejan Japaridze, Marina Gigolashvili

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The variations of solar differential rotation have been studied at the moment of solar polarity reversal for solar activity cycles 20 and 21. There were used Hα filaments data obtained in the Abastumani Astrophysical Observatory and the compact magnetic features data from the atlas of synoptic maps. It is established that before and after one-fold polarity reversal (cycle 21) of solar magnetic field for each hemisphere the compact magnetic features with the polarity of the circumpolar magnetic field have larger rotation rates than the elements with the opposite polarity. But in the moment of three-fold polarity reversal (cycle 20) this regularity is disturbed. Rotation rates variations of compact magnetic features with both negative and positive polarities are different from rotation rates variations of filaments both during the whole cycle and during the moment of polarity reversal of the solar magnetic field.

SOLAR SPECTRAL IRRADIANCE VARIABILITY AND ITS POSSIBLE CONNECTION WITH THE COSMIC RAYS DURING THE DECREASING PHASE OF THE SOLAR ACTIVITY CYCLE 23

Natela Kapanadze, Marina Gigolashvili

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We present the results of investigation of the time structure of the solar spectral irradiance (SSI) with special attention to components of characteristics of the space weather. The statistical analysis of data of the solar spectral irradiance is carried out during 2003-2008, using the data from the Solar Irradiance Datacenter's website LASP.

The investigation of the SSI and CR intensities variations using last space observations by different precise devices during 2003-2008 and ground-based observations in Oulu with a standard 9-NM-64 neutron monitor (NM) is presented.

By spectral analysis of the temporal changes of the high-cadence time series in SSI and CR revealed a periodic behavior in main periods with high amplitudes. It is found anti-correlation between CR and SSI during investigated period. Only in the case of spectral range 405.990 nm take place correlation with CRs.

STUDIES OF CMES CAUSING GEOMAGNETIC STORMS IN THE PERIOD 2007-2011

Daniela Adriana Lăcătuş[1,4], Alin Razvan Paraschiv[1,4], Marilena Mierla[1,2,4], Luciano Rodriguez[2], Emilia Kilpua[3]

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We have selected the coronal mass ejections (CMEs) in the period 2007-2011 which were directed towards the Earth and produced geomagnetic storms (Dst < -30 nT). We used the data from the SECCHI-COR2 coronagraphs on-board the STEREO mission to derive the true speeds and direction of propagation of these CMEs. We applied the flux-rope like model introduced by Thernisien et al. 2006 on these events in order to derive their 3D parameters (direction of propagation, angular width, orientation etc.). We then compared the obtained values with in-situ data measured when the CME reached the spacecraft at Earth (ACE).

SPECIFIC FEATURES OF THE HIGH-SPEED STREAMS IN THE SOLAR WIND AND GEOMAGNETIC STORMS DURING THE LAST PROLONGED SOLAR MINIMUM

Georgeta Maris Muntean[1], Constantin Oprea[1], Marilena Mierla[1,2,3], Oana Stere[1]

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Solar activity and its consequences on the heliospheric space variability are governing and perturbing the Earth's magnetosphere. The response of the terrestrial magnetosphere displayed as geomagnetic storms is measured by several geomagnetic indices. Defining a minimum phase of the solar 11-yr cycle as the period with the monthly relative sunspot numbers (smoothed values) less than 20, we considered for this analysis the interval February 2006–September 2010. The High-Speed Streams (HSSs) of the solar wind were determined by their main parameters: initial and maximum velocities, duration, velocity gradient and an intensity (importance) index. A comparative analysis of the HSS dynamics during the last solar minimum with the previous solar minimum (1996-1997) was made using the above-mentioned parameters. Some features during the initial and main phases of 21 moderate and two intense geomagnetic storms induced in the terrestrial magnetosphere (using Dst geomagnetic index) were marked out. A comparative analysis with the geomagnetic activity of the previous solar minimum (1996–1997) was also made. The results are discussed in the context of the different variability of the solar magnetic fields during the two last minima.

HELIOPHYSICAL RESEARCH IN GREECE: THE SPACE WEATHER PERSPECTIVE

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In this work, we will present Space Weather (SW) investigations and activities in Heliophysics currently carried out in Greece. Greece hosts several space weather assets, such as ionospheric stations, neutron monitor recordings and radio emission measurements. Over the years several groups have been engaged in significant cooperative efforts and developed algorithms and products that are now being broadly used in the space weather community. The National Kapodistrian University of Athens (NKUA) maintains the ARTEMIS-IV radio spectrograph and the Athens neutron monitor infrastructures, disseminating the GLE warning alert to the scientific community, while the NKUA research groups are strongly involved in basic science of space storms e.g. solar flares, CMEs. The University of Ioannina (UoI) group is heavily involved in the interpretation and analysis of radio measurements. The Democritus University of Thrace (DUTH) takes part in many research projects most of which are targeted towards radiation hardening and the protection of space assets. The National Observatory of Athens (NOA) is currently strongly involved in many projects providing, among others, advanced ionospheric products for end users. NOA is also involved in two SW related collaborative projects funded by the 7th Framework program of the European Union: 'SEPServer' and 'COMESEP'. 'SEPServer' focuses on the implementation of a comprehensive and up to date Solar Energetic Particle (SEP) analysis service including scientific data-driven analysis both for 1 AU and for > 1 AU using data from the SOHO/ERNE, SOHO/EPHIN, ACE/EPAM, ACE/SIS, WIND/3DP, Ulysses/HISCALE, Ulysses/COSPIN/LET and Ulysses/COSPIN/KET experiments. SEPServer will also provide for the first time the release of the HELIOS data set in full time resolution, thus making available data also for orbits down to 0.3 AU. Direct comparison of observed SEP fluxes, spectra and abundance ratios with the associated electromagnetic emission data will be applied. 'COMESEP' sets out to develop tools for forecasting SEP radiation storms and geomagnetic storms based on scientific data analysis and extensive modeling. These forecasting tools will be incorporated into an automated operational SW Alert system. Basic research activities on SW carried out at NOA will be presented including the analysis of SEPs and the associated electromagnetic emissions, the detailed study of the so-called 'reservoir effect' in the heliosphere as well as investigations into SEP sources, and acceleration processes operating on SEPs in terms of solar flares, ICMEs and their associated shocks. These activities will provide the basis for future missions such as Solar Orbiter - in which NOA participates as a Co-Investigator (EPD instrument).

SLOW SOLAR WIND

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The flows in the solar corona were identified of being of different types: slow solar wind (speeds of around 400 km/s), fast solar wind (speeds of around 700 km/s) and coronal mass ejections (speeds in the range < 100 km/s > 2000 km/s).

The coronal holes (CH) ("open" magnetic field structures) were identified as the main source regions of the fast, mostly uniform, solar wind. Conversely, the slow solar wind (SSW), which shows large excursions in speed and elemental abundances, is believed to originate in streamers (closed magnetic structures). Several models were created in order to explain the source region of the slow solar wind. Still, the origin of the slow solar wind is not well understood: Do we see slow solar wind originating: (a) at the level of streamer cusp?, (b) in the regions surrounding the streamer, close to the streamer boundary? or (c) from both streamer cusp and streamer boundary? This talk is a review of observations and models regarding the slow solar wind, in regions close to the Sun.

EMPIRICAL MODEL FOR PREDICTING THE OCCURRENCE OF MAJOR GEOMAGNETIC STORMS DURING SC23

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During solar cycle 23 (1996-2008) there were 25 major geomagnetic storms (Dst < -150 nT) for which clear coronal mass ejections (CMEs) could be associated. In general, several CMEs are associated with a single geomagnetic storm. In this study, we selected the most probable CMEs that could have produced the storms, as given in the list of Zhang et al. 2007. In this way, for each geomagnetic storm, there is only one CME associated, in our list of selected events.

For the above 25 geomagnetic storms, we identified several solar parameters of the source CMEs (for example, 3D speed, location, flare magnitude etc.) that could help in forecasting the occurrence of a resulting geomagnetic storm. We applied a logistic regression model (as described in Srivastava 2005) to these events using the selected solar parameters as inputs in order to predict the occurrence of the major geomagnetic storms. Results of the application of the model to our data are presented together with a detailed analysis of the source regions of the CMEs.

INTERSTELLAR NEUTRAL ATOMS AND THEIR JOURNEY THROUGH THE HELIOSPHERE

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The heliosphere, the volume inflated by the solar wind, is impenetrable to interstellar plasma, except for high-energy galactic cosmic rays. Neutral components of the local interstellar medium (LISM), however, do enter at the speed of Sun's relative motion to LISM. On their journey through the heliosphere, interstellar neutrals are subject to ionization by solar wind protons and electrons, solar photons, and also the gravitational pull of the Sun. Once ionized, the newly created ions, called "pickup ions'' (PUIs), are swept out by the solar wind toward the termination shock. Helium atoms, having a higher ionization potential, penetrate deeper into the solar system, with their trajectories gravitational focused to form a cone of high concentration of LISM He in the wake of the Sun's motion through LISM. This He cone provides a rich source of He+ PUIs. Recent theories suggest that PUIs are the seed particles for the detected anomalous cosmic rays — singly charged ions highly enriched in He, N, O, and Ne.

HAWAI'I CENTER FOR ADVANCING SISTEMIC HELIOPHYSICS EDUCATION (HI CA$HED)

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The Hawai'i Center for Advancing $ystemic Heliophysics Education (HI-CA$HEd) operates at the Institute for Astronomy. In the HI-CA$HEd, we undertake vigorous activities on all levels of engagement aimed at educating the students, teachers, and the general public of Hawai'i about: (i) the Sun, interplanetary space, and most of the rest of the Universe are made up of plasma, and how this plasma interacts with, and how it is coupled to, electro-magnetic forces; (ii) the variability of the Sun in every wavelength, and the manner by which that variability manifests itself in the solar magnetic field, bulk plasma flow (the solar wind), and energetic particles; and (iii) the harsh conditions in the space environment, which may pose significant risks for the journey of exploration.

STUDY OF SOLAR PARAMETERS CAUSING MAJOR GEOMAGNETIC STORMS DURING SC 23

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In this paper we analyze the coronal mass ejections (CMEs) directed towards the Earth along with their sources and interplanetary manifestations, which caused 25 major geomagnetic storms during the solar cycle 23. Using the data provided by SOHO, ACE and geomagnetic stations we study in detail the solar and geomagnetic signatures, the dependence between the source events and CMEs and the CMEs kinematics. We examine also the in-situ parameters, the energy transfer flux into magnetosphere and the geomagnetic indexes, Dst and Kp by computing their correlation coefficients and applying the superposed epoch analysis.

EFFECTS OF HYSTERESIS BETWEEN MAXIMUM CME SPEED INDEX AND GEOMAGNETIC

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Using the smoothed time series of maximum CME speed index data set for solar cycle 23, it is found that this index, analyzed jointly with two geomagnetic indices, show a hysteresis phenomenon. It is observed that Ap and Dst indices follow different paths for the ascending and the descending phases of solar cycle 23, while a saturation effect exists at the maximum phase of the cycle. However it is noticed that the separations between the paths are not the same for the geomagnetic activity indicators used. Lag times with respect to the maximum CME speed index is discussed, confirming that hysteresis represents a clue in the search for physical processes responsible for changing solar emission.

CYBERDYN: A STATE-OF-THE-ART SUPERCOMPUTING FACILITY AT THE INSTITUTE OF GEODYNAMICS OF THE ROMANIAN ACADEMY

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In recent years, modeling and computation have come to play an central key role in modern sciences, and one of the reasons is due to the increased use of fine spatial grids and small time steps for integration used for solving numerically systems of equations that express mathematically a physical process. Today's scientists need access to new information technology capabilities, able to perform high-resolution, complex computing simulations in a reasonable time frame. Sophisticated simulation tools allow us to study phenomena that can never be observed or replicated by standard laboratory experiments. Modeling complex natural processes in general, and doing this using numerical computation in particular, represents today an essential tool of research. All modern research centers benefit from a computing center of one form or another. Computational modeling represents a powerful tool in the field of Earth Sciences and other research fields. As geodyninamic scientists, we use it to model large-scale processes inside the solid Earth.

In this study we introduce the newly implemented state-of-the-art CyberDyn parallel machine, a High Performance Computing Cluster (HPCC) with 1344 computing cores and high-speed network connectivity available at the Institute of Geodynamics of the Romanian Academy. This computational infrastructure targets large-scale high-resolution geodynamic simulations, and not only. We measured the performance of HPCC CyberDyn using the parallelized open source code CitcomS, which is widely used in the solid earth community (www.geodynamics.org). The benchmark tests are performed using a series of 4D geodynamic settings ranging from regional to full-spherical models.

The benchmark results show that the HPCC CyberDyn offers the opportunity to perform fast simulations, used to study dynamic models with parallelized codes that scale well on 100s or even 1000s of processors. In the same time the high-speed QDR Infiniband interconnect offers the possibility to exploit the full potential of large clusters, and represents a key component that positively influence both, scalability and performance on large HPC systems. Since presently we are moving towards high-resolution simulations for geodynamic predictions that require the same scale as observations (from several to thousands of kilometers), HPC facilities used in earth sciences should benefit from larger up-front investment in future systems that are based on high-speed interconnects.

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INTERNAL CHARACTERISTICS OF MAGNETIC CLOUDS AT 1 AU

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Magnetic clouds (MCs) are a subset of interplanetary coronal mass ejections (ICMEs). They are important due to their internal magnetic field configuration, which resembles a magnetic flux rope, and because they represent the most geoeffective type of solar transient. In this study, we analyze their internal structure using a superposed epoch method of a large set of events detected at L1, between 1996 and 2006. We highlight the most important characteristics and compare the internal parameters with those seen in the surrounding solar wind. In particular, we are interested in the density increase seen at the trailing part of some magnetic clouds. Furthermore, we link events with their solar counterparts and compare the remote observations in EUV and white-light with the in situ data. With Solar Orbiter we will be able to do this study closer to the Sun and provide new insights into the linking of CMEs and ICMEs.

THE ASYMMETRY OF THE SOLAR CYCLE: ANALYSIS OF THE CYCLE #24 FORECAST

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In an early paper we analyzed the asymmetry of the sunspot cycles from the point of view of its non-linearity. There are many attempts to predict the features of the future evolution of the solar activity which are based on different models for fitting the shape of Wolf number evolution. None of them are fully satisfying and the recent delay of the solar cycle #24 is one example. Unfortunately the majority of the predictions are based on the numerical analysis, and just a few attempts to base the forecast on a physical basis. We try to go closer to a solution of the prediction problem, using some physical evidences we found presented in the early article and now we made a critical analysis of our prediction based on the accumulated data from 2007.

GLOBAL MHD MODELING OF CMES AND RELATED SHOCK WAVES ORIGINATING FROM COMPLEX ACTIVE REGIONS

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The physical causes of coronal mass ejections (CMEs) have been debated by the solar community for four decades now. The vast majority of proposed models agree that CMEs are the result of catastrophic loss of mechanical equilibrium or stability of the coronal magnetic field due to changes in the distribution of magnetic flux elements at the photosphere. These models usually involve idealized physical circumstances with either dipolar or quadrupolar underlying magnetic field geometries. The real Sun, however, demonstrates cases far more sophisticated than those idealized configurations. Therefore, studying the actual magnetic field geometries involved during CMEs is crucial for understanding the dynamical time scales of the eruption, acceleration profiles, etc. This talk summarizes the simulated dynamics of actual CME events and associated shock waves, and their comparison with observations. We discuss the influence of the global magnetic field on the geometry of the CME-driven shock waves, and the possible implications for the production of solar energetic particles.

HELIOPHYSICS: ANATOMY OF SOLAR ANGER

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For a few centuries now the Sun has been diagnosed with cyclophrenia (or manic-depressive psychosis). This behavior is characterized by the occurrence of mania (or euphoria) during the so-called solar maximum, alternated with bouts of depression during the so-called solar minimum. The cycle of this behavior is 11 years, which is also known as solar cycle. In addition to this predicable part of Sun's behavior, there is also an unpredictable component characterized as solar anger. The solar anger first starts with the misplaced stage (accumulative, or implosive, stage for later explosive behavior), followed by a second, excessive stage that yields solar flares and coronal mass ejections. It has been only three decades since heliophysicists have begun to understand—through sophisticated observations and state-of-the-art numerical simulations—the true nature of solar anger. Heliophysics also attempts to predict and manage Sun's wrath. The talk focuses on solar anger management and what can be learned from it for the sake of better education.

INTERNAL AND EXTERNAL CLIMATE FACTORS INFLUENCING TEMPERATURES ANOMALIES IN THE NORTHERN HEMISPHERE

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We have evaluated the role of solar and climatic factors in the distribution of temperature in the Northern Hemisphere's troposphere and stratosphere. Solar UV data, teleconnection indices from the Euro-Atlantic zone, namely the North-Atlantic oscillation, the Arctic Oscillation and the Scandinavian Oscillation and temperature anomalies in troposphere and stratosphere in the Northern Hemisphere - obtained from weather balloon observation for the period 1959-2005 - were analyzed. Correlations studies were performed for annual and seasonal level. From the external factors we have underlined good correlations for UV, but also for CR. The role of atmospheric dynamics on temperature anomalies in t76yuyh8787875878erhe troposphere and stratosphere is much clearer. North Atlantic Oscillation and Scandinavian Oscillation present the most visible impact on temperature. As a main conclusion, temperature anomalies in the troposphere are strongly related with internal dynamic factors while stratospheric temperature variations depend both on solar forcing and on atmospheric circulation. Possible mechanisms and implications for solar effects on climate are discussed.

PROPERTIES OF DECAMETER TYPE IIIB BURSTS

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As known Type IIIb bursts is a chain of short, narrow-band bursts, which slowly drifts from high to low frequencies, in a manner similar to the normal Type III bursts. This report deals with analysis of Type IIIb bursts, which were observed in frequency band from 18 to 30 MHz on July - August 2002. The main parameters for some tens of Type IIIb bursts such as amount of stria in a burst, duration, frequency width, emission flux, and frequency drift rate were obtained. Every Type IIIb bursts consists of more than 35 stria-bursts. The time profile of stria is similar to typical Type III burst with fast rise and slower fall. The frequency profile of stria is symmetrical. In all cases the average duration is about 1 – 1.4 s. The average bandwidth of stria is 60 - 80 kHz for all analyzed bursts. There is no any characteristic dependence between radio emission fluxes and observational frequency.

THE EVOLUTION OF THE EARTH'S MAGNETIC MOMENT IN THE LAST 400 YEARS. CONSEQUENCES ON THE MAGNETOPAUSE STANDOFF DISTANCE

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The standoff distance of the magnetopause is controlled by the balance of the solar wind dynamic pressure on the magnetosphere and the pressure of the Earth's magnetic field, $P = \frac{B^2}{8\pi} = \frac{1}{8\pi}\left(\frac{fM}{L^3}\right)^2$, where P is the dynamic pressure, M is the magnetic moment of the Earth and L is the magnetopause standoff distance. In our previous work we succeeded to reconstruct P and L before space era (1964), back to 1870, based on the very good correlation of P with the geomagnetic activity (aa and AE indices) during the space era. We analyze the evolution of the Earth's magnetic moment over a time span of 400 years using the gufm1 main geomagnetic field model (Jackson et. al, 2000) and how this influences the standoff distance of the magnetopause. Starting from 1590, the geomagnetic dipole moment of the Earth has decayed with an average rate of about 0.05% per year. A discussion is made on the possible variation of P and L during grand minima and grand maxima of the solar activity, based on the reconstruction of Usoskin et al. (2003).

THE STUDY OF CORONAL MASS EJECTIONS TRAVEL TIME TO THE EARTH

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In this study we have analyzed two cases of major geomagnetic storms (Dst < - 200nT) associated with one, respectively three coronal mass ejections (CMEs). The analysis is focused on calculation of real speed of CMEs, using the sphere model of an CME, in order to estimate the travel time of the CME to the Earth and to compare it with the real travel time (the difference between the time when the CME was registered at ACE and the time when the CME left the Sun). We will discuss possible implication for forecasting the arrival time of the CMEs at the Earth, as well as their interaction with the ambient solar wind and/or other CMEs.

WHERE COMMUNICATION AND SPACE WEATHER MEET

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Research, including observations, instrumentation and product development are the goals of scientists working in the field of space weather. A publication in a refereed journal about this research and development is a justification and validation of the work performed. However, these results should go beyond a publication and beyond the scientific community.

Dissemination, exploitation and education of space weather science provide the tools to make this extra step. Also, space weather projects and the space weather community in general have been putting a larger emphasis on this the last few years. We will present some of the communication efforts done in the past.

IONOSPHERIC PERTURBATIONS INDUCED BY INTERPLANETARY AND SOLAR FORCING

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Solar terrestrial coupling generates various processes in magnetosphere, ionosphere and terrestrial environment, via interplanetary magnetic field (IMF) and associated interplanetary electric field variations propagating downwards at ionospheric heights. Most of these processes take place at high latitudes, where geomagnetic field lines extend far into the near-space and connect to solar wind.

Examples of such phenomena occurring in different regions of the near Earth environment are considered in this presentation: sporadic E (Es) layers, the F region trough and subauroral ion drifts (SAIDs and ASAIDs). Es layers are narrow horizontal layers whose density is several times higher than the background which form in the E region, around 90-125 km. The ionospheric trough is a density depletion in the F region ionosphere, around 300 km (where the depletion is the strongest) and SAIDs are observed in the middle-top ionosphere (from 300 km to 800 km and higher).

The origin of these processes is not necessarily the solar-terrestrial coupling but their development, characteristics might depend significantly on the state of solar and interplanetary environment. Experimental results show that the IMF orientation has an important effect on the occurrence of sporadic E layers and F region trough while SAIDs are most likely generated by particular configurations of the inner magnetosphere, which is also sensitive to IMF orientation and variation. Other characteristics of the F region trough, as the coincidence with the plasmapause, might also be a manifest at ion of Sun-Earth links.

AUTHOR INDEX:

NUME	INSTITUTION	TITLE	Session	Type	Page
Gigolashvili Marina	Abastumani Astrophysical Observatory at Ilia State University	Comparative Analysis of Variations of the Solar Spectral Irradiance in Connection to Solar Activity Cycles and Solar Magnetism	1	O	13
Greculeasa Razvan	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Sources of the geomagnetic activity at local scale. Case study - European geomagnetic observatories	5	P	14
Hanea Gabriel Remus	TNO Utrecht, Technical University, Delft, Netherlands	Data Assimilation and its applications	8	O	15
Japaridze Darejan	Abastumani Astrophysical Observatory at Ilia State University	Study of variations of rotation rates of Hα filaments and compact magnetic features at the moment of polarity reversal of solar magnetic field	1	O	16
Kapanadze Natela	Abastumani Astrophysical Observatory at Ilia State University	Solar Spectral Irradiance Variability and its Possible Connection with the Cosmic Rays during the Decreasing Phases of the Solar Activity Cycle 23	4	O	16
Kirov Boian	Space Research ant Technologies Institute - BAS	Solar magnetic field and geomagnetic activity	1	P	14
Lacatus Daniela Adriana	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Studies of CMEs causing geomagnetic storms in the period 2007-2011	3	P	17
Malandraki Olga	National Co-ordinator International Space Weather Initiative (ISWI), National Observatory of Athens, Athens, Greece	Heliophysical Research in Greece: the Space Weather Perspective	3	O	18
Maris Muntean Georgeta	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Specific Features of the High-Speed Streams in the Solar Wind and Geomagnetic Storms during the Last Prolonged Solar Minimum	3	O	17
Mierla Marilena	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Slow Solar Wind	3	O	19
Mierla Marilena	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Empirical model for predicting the occurrence of major geomagnetic storms during SC23	3	O	19
Moise Elena	Institute for Astronomy, University of Hawai'i, Honolulu, HI 96822, USA	Interstellar Neutral Atoms and their Journey through the Heliosphere	8	O	20

NUME	INSTITUTION	TITLE	Session	Type	Page
Moise Elena	Institute for Astronomy, University of Hawai'i, Honolulu, HI 96822, USA	Hawai'i Center for Advancing Sistemic Heliophysics Education (HI CA$HEd)	8	O	20
Oprea Constantin	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Study of solar parameters causing major geomagnetic storms during SC 23	5	O	21
Özgüç Atila	Kadilli Observatory	Effects of Hysteresis between Maximum CME Speed Index and Geomagnetic	3	O	21
Paraschiv Alin Razvan	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	Internal characteristics of magnetic clouds at 1 AU	3	P	23
Pomeran Mihai	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	CYBERDYN: a State-of-the-Art Supercomputing Facility at the Institute of Geodynamics of the Romanian Academy	8	P	22
Roussev Ilia	Institute for Astronomy, University of Hawai'i, Honolulu, HI 96822, USA	Heliophysics: Anatomy of Solar Anger	8	O	24
Roussev Ilia	Institute for Astronomy, University of Hawai'i, Honolulu, HI 96822, USA	Global MHD Modeling of CMEs and Related Shock Waves Originating from Complex Active Regions	3	O	24
Rusu Mircea V.	University of Bucharest, Faculty of Physics	The asymmetry of the solar cycle: Analysis of the cycle #24 forecast	1	O	23
Sfîcă Lucian	Alexandru Ioan Cuza University, Iaşi, Romania	Internal and external climate factors influencing temperatures anomalies in the Northern Hemisphere	7	P	25
Shevchuk Mykola	Institute of Radio Astronomy, Ukrainian Academy of Sciences, Kharkov, Ukraine	Properties of decameter type IIIb bursts	3	P	25
Stefan Cristiana	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	The evolution of the Earth's magnetic moment in the last 400 years. Consequences on the magnetopause standoff distance	5	P	26
Stere Oana	Institute of Geodynamics of the Romanian Academy, Bucharest, Romania	The study of coronal mass ejections travel time to the Earth	5	O	26
Vanlommel Petra	Solar-Terrestrial Centre of Excellence, Royal Observatory of Belgium, Brussels, Belgium	Where communication and space weather meet	8	O	27
Voiculescu Mirela	Dunarea de Jos University of Galati, Romania	Ionospheric perturbations induced by interplanetary and solar forcing	6	O	27

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Brief History

The **"Sabba S. Stefanescu" Institute of Geodynamics of the Romanian Academy** (IG"SSS"AR) was constituted in 1990, simultaneously with the revival of the Romanian Academy. At its constitution, the Institute was based on the Laboratory of Geodynamics and the research group for natural fields, which used to be, together with a Laboratory of Seismology and a Laboratory of Rock Mechanics, parts of the Centre of Earth Physics and Seismology**.** The latter became in 1990 the National Institute for Earth Physics.

The Institute continues a tradition begun in the framework of the Geophysical Research Centre of the Romanian Academy when, on the occasion of the February 15, 1961 total solar eclipse, it may be considered that experimental Geodynamcis was introduced in our country. On the occasion of this eclipse, in a building belonging to the Caldarusani monastic complex the first recordings of the variations in time of the gravitational field in our country were carried out, using as a sensor an Askania type gravimeter and recording systems of own construction.

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Honorary Director:
Dr.ing.Dorel Zugravescu,
Corresponding member of the Romanian Academy
Structure:
Laboratories: 6
Administration: 3
Human resources:
82 employees, out of which 49 research staff.

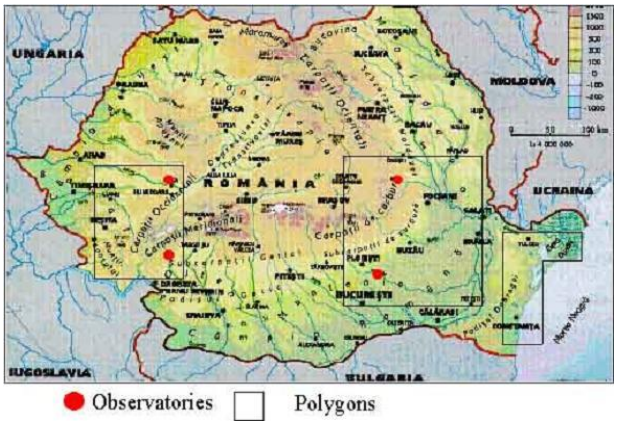
Research directions

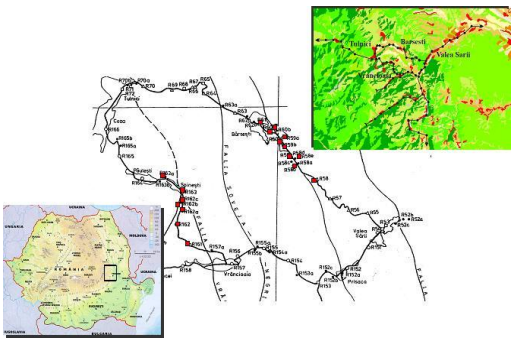
Since its foundation, the Institute of Geodynamics "Sabba S. Stefanescu" of the Romanian Academy focused its interest on fundamental research imposed by the tasks implied by the Priority Program of the Romanian Academy, "Complex geophysical research in geodynamically active areas concerning especially the Vrancea seismogenic area", regarding particularly:

- the study of space-time variations of parameters causally linked to the accumulation of stresses responsible for earthquakes occurrence;
- the study of natural hazard (tectonic, seismic, landslides, etc.)
- the monitoring of space-time variations of the gravitational, geomagnetic, geoelectric fields of the Earth, of the crust tilts and of the relative displacements of tectonic blocks;
- modeling of the thermo-mechanical evolution of the lithosphere;
- non-linear analysis of geodynamic systems;
- studies of endogeneous processes in the geodynamic evolution of the Romanian territory;
- study of geomagnetic field in relation with physical processes in heliosphere;
- complex geophysical studies in areas affected by anthropogenic activities.

Research infrastructure

At present, the Institute has a network of observatories and observation points, structured in profiles and geodynamics polygons, all having as a main purpose a better knowledge of phenomena leading to stress cumulating/earthquake triggering in geodynamically active areas, with a special concern for the geodynamically active area of the Romanian Carpathians bend - the Vrancea seismogenic zone. The network is concentrated in three geodynamics polygons: the Caldarusani-Tulnici Geodynamics Polygon, the Craciunesti-Deva, Sarmizegetusa Regia, Pades-Gorj Geodynamics Polygon and the Danube Delta - Mangalia Geodynamics Polygon.





The location of the Vrancea Natural Laboratory for Geodynamics

Among these polygons, a special place is occupied by the Caldarusani-Tulnici Geodynamics Polygon which includes - besides the laboratories for equipment gauging and aging, arranged in the framework of the Caldarusani Geodynamics Observatory, in the basement of the group of buildings that constitute the headquarters of the IG"SSS"AR, and in the basement of the headquarters of the Romanian Academy - several micropolygons consisting of over 200 observation points, that allow the performing of repeated measurements, usually at 6 months up to 5 years intervals, and of underground laboratories, which allow data acquisition - within the limits of the possible, without interruption - corresponding to variations in the crust tilt and in the gravity, the magnetic and the electric fields in Vrancea area.

Among these micropolygons, the most important one - the Micropolygon I Tulnici - is situated in the Vrancea geodynamically active area on both sides of the contact on which the hypocenters of the Vrancea seismogenic area are situated, to a depth that may exceptionally exceed 180 km.

We underline the fact that at present, the Caldarusani Geodynamics Observatory is functioning in the building where recordings were carried out on the occasion of the total solar eclipse in February 1961 and that the co-operation established in 1961 between the Caldarusani Monastery and the Caldarusani Geodynamics Observatory.

The Craciunesti-Deva, Sarmizegetusa-Regia, Pades-Gorj Geodynamic Polygon is constituted, in its northern part, of a set of underground observatories including laboratories situated at depths exceeding sometimes 100 m below the soil surface, where the sensors are located far from any influences of anthropic activities and at a distance of about 300 km of the Vrancea geodynamically active area; these laboratories, which allow recordings that are subject only to low perturbation by parasite noises, have the role to provide a valuable reference information.

At the Institute of Geodynamics of the Romanian Academy a cyberinfrastructure was implemented in 2011. It consists of a High Performance Computing Cluster/High Performance Visualization Cluster/GeoWall system able to run/visualize 3D high-resolution numerical models with the main goal to answer key questions concerning the origin of the Vrancea seismogenic zone. Moreover, we plan to widely share our modeling results with the scientific community through an interactive web portal. Also, we are looking to further cooperation in which we can share the computing power.

Ph.D. Programmes

The institute organizes Ph.D. programmes in the domain of Earth Sciences – Geology

International Cooperations

Cooperation with:

- the Royal Belgian Observatory - Belgium
- the Institute for Theoretical Geodesy of the University of Bonn - Germany
- the Institute of Geophysics of the University of Karlsruhe, Germany
- the Walferdange Observatory - Grand-Duché de Luxemburg
- the Institute of Earth Physics Paris - France,
- the Laboratory of Geophysics of Aarhus University, Denmark
- the United Institute of Earth Physics - Moscow, Russia
- the Institute of Geophysics and Geology - Kishinew, Republic of Moldavia
- the Institute of Geophysics - Bratislava, Slovac Republic
- the Institute of Geodesy and Geophysics - Sopron, Hungary
- the Institute of Nuclear Research - Debrecen, Hungary
- the Institute of Seismology and Volcanology of Hokkaido University, Japan,
- the United States Geological Survey, USA.

Research Grants

- 3 European projects and over 40 grants with Romanian Academy and Ministry of Education and Research (CNCSIS, AEROSPATIAL, CERES, MENER, CEEX, UEFISCDI)

- A special project with European Funds in the Sectorial Operational Programme "Increase of Economic Competitiveness" POS-CCE, Priority Axis 2 - "Research, Technological Development and Innovation Competitiveness", Operation 2.1.2 - "Complex research projects fostering the participation of high-level international experts", is “CYBERDYN: Cyberinfrastructure for Geodynamic Studies Related to the Vrancea Seismogenic Zone”.

Other

During 2001, the "Sabba S. Stefanescu" Institute of Geodynamics of the Romanian Academy founded, in cooperation with the United Institute of Earth Physics "O.Yu.Schmidt" of the Russian Academy of Sciences, the International Virtual Laboratory of Geodynamics (LIVG), supported by UNESCO - Paris. This is currently becoming an international network of specialists from institutes interested in geodynamics: the Geodynamics Group in the Section for Oil, Mines and Geonomy of the Academy of Technical Sciences of Romania, the National Institute of Earth Physics, the Institute for Fine Mechanics, the National Institute for Building Research, the Institute of Geophysics of the University of Karlsruhe (Germany), the Institute of Geophysics and Geology of the Academy of Sciences in Chisinau (the Republic of Moldova) and Institut de Physique du Globe - Paris, le Département de Géophysique Appliquée de l'Université Pierre et Marie Curie, Académie de Paris (France).

A mobile Geodynamics laboratory is being modernized, which has been used for complex geophysical measurements in geodynamically active areas also outside the country (electromagnetic soundings, electrometric measurements, soil vibration measurements, measurements of the electric, magnetic, and gravity fields), providing information about the vertical distribution of some of the physical parameters which characterize the various compartments of the Earth interior, from Earth surface to the depths that, for some of the parameters, may significantly exceed the thickness of the lithosphere.

In 2005, a vertical pendulum of own design has been constructed. It was installed in the Underground Geodynamic Observatory Craciunesti-Deva. This highly sensitive pendulum, with a 25 kg mass, has a length of 17 m and an oscillation period of 8 s.

In 2004 the first Romanian UNESCO Chair in Geodynamics was established, chairholder: Dr.ing. Dorel Zugravescu, corresponding member of the Romanian Academy. Several scientific sessions and field trips were organized under the auspices of this Chair, with researchers from the Royal Observatory of Belgium, Institute of Earth Physics Paris, France, Institute of Geophysics of the Academy of Sciences of Ukraine, Fribourg University, Switzerland, Saint Mary's University, Halifax, Canada.

As we mentioned before, in 2011, at the Institute of Geodynamics of the Romanian Academy a cyberinfrastructure was implemented, consisting of a High Performance Computing Cluster/High Performance Visualization Cluster/GeoWall system able to run/visualize 3D high-resolution numerical models with the main goal to answer key questions concerning the origin of the Vrancea seismogenic zone. The Institute of Geodynamics of the Romanian Academy is open to further scientific cooperation using this infrastructure.

http://www.rosa.ro/index.php/en.html

Romanian Space Agency (ROSA) was established in 1991 and reorganized by a Government Decision in 1995 as an independent public institution under the auspices of the Ministry of Research and Technology (actually, the Ministry of Education, Research, Youth and Sport). ROSA is the national co-ordinating body of the space activities.

The missions of ROSA are to promote and coordinate development and national efforts in the field, and, as a Government representative, to promote international cooperation. In particular, ROSA is authorized to establish research and development centres oriented on specific objectives of the Romanian Space Programme. ROSA is developing its own research and development projects.

On behalf of the Government, ROSA is the national representative in the cooperative agreements with international organizations, such as European Space Agency (ESA) and Committee on Space Research (COSPAR), as well as bilateral governmental agreements. Together with the Ministry of Foreign Affairs, ROSA is representing Romania in the sessions of the United Nations Committee on the Peaceful Use of Outer Space (COPUOS) and its Subcommittees.

The President (since 2004) and Chief Executive Officer (since 1995) of ROSA is Mr. Marius-Ioan Piso, Ph.D. Prof. The Honor President is the Romanian cosmonaut Mr. Dumitru Dorin Prunariu Ph.D. Eng.

History

Romania is recognized as a country with aerospace tradition and detains a basis for the space enterprise in the future:

The existence of historical personalities such as Conrad Haas (constructor of the multistage rockets with delta stabilizers, Sibiu - 1529), Aurel Vlaicu (first Romanian aerospace engineer),

Traian Vuia (designer and constructor of the first autonomous take-off aeroplane in 1906), Henri Coanda (designer and constructor of the first jet aeroplane in 1910), Hermann Oberth (designer of space rockets and "father of space navigation"), Elie Carafoli (important contributions in aerodynamics and and space sciences, president of the IAF in 1961, 1962);

The development of the aeronautical industry which presently includes the manufacturing, based on original design or under license, of more than twenty types of transport airplanes, helicopters, passenger medium couriers, and light airplanes; Romanian contributions to more than thirty scientific and technological space missions including the mission of the first Romanian cosmonaut in 1981;

The experience in the field of space applications; since 1977 the Cheia Intelsat ground station with two 32 m antennas is operational; applications of remote sensing imagery and Geostationary Positioning System technology performed for the oil industry, agriculture, environment, cartography, and land use;

The large sector of commercial space applications, as space communications, applications of satellite remote sensing, geographic informational systems, positioning and navigation, global information systems.

In order to reconsider the importance of space activities as necessary elements for the development of the Romanian community, the public administration in co-operation with the private entities have created and supported this endeavor.

The Agreement on Romania's accession to the ESA Convention was signed on 20 January 2011 in Bucharest, by Jean-Jacques Dordain, Director General of ESA, Teodor Baconschi, Romanian Minister of Foreign Affairs, and Marius-Ioan Piso, President and CEO of the Romanian Space Agency.

Following this signing, the process of ratification by the Romanian government began. This process was concluded last year and, as of 22 December, Romania deposited its instrument of ratification of the ESA Convention in Paris, becoming an official ESA Member State.

Romania's cooperation with ESA is long standing. In 1992, Romania was one of the first Eastern European countries to sign a Cooperation Agreement in the field of the peaceful use of outer space with ESA, paving the way for Romanian participation in several research projects with other European countries.

Cooperation between ESA and Romania was strengthened further in October 1999 with the signing of a five-year Framework Cooperation Agreement, and the signature of the European Cooperating State Agreement in 2006.

Romania has participated in several ESA missions, such as Cluster, Herschel, Planck, SOHO and Gaia with co-investigators, and in Earth Observation activities (EDUSPACE software), microgravity and exploration (SURE) and technology activities (the IAP telemedicine project).

http://www.yorku.ca/scostep/

Organizational information and brief history

The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) was originally established in January 1966 by the XIth General Assembly of the International Council of Scientific Unions (ICSU) as the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP.) At its XIVth General Assembly in September 1972, ICSU reorganized IUCSTP as a special committee with responsibility for interdisciplinary solar-terrestrial physics programs of finite duration. The designation SCOSTEP took effect in September 1973 after the ratification of a new Constitution by the ICSU Executive Board and General Committee. In September 1978, with the ratification of the current Constitution by the XVIIth ICSU General Assembly, SCOSTEP became a Scientific Committee of ICSU charged with the long-term responsibility to promote international interdisciplinary programs in solar-terrestrial physics. In May 1982, SCOSTEP held its first General Council Meeting under the new Constitution. The Constitution was revised in 1988.

The Scientific Committee on Solar-TErrestrial Physics (SCOSTEP) organizes and conducts international solar-terrestrial physics (STP) programs of finite duration in co-operation with other ICSU bodies. They share results of these programs by joining in conducting meetings, conferences, and workshops and by publishing newsletters, handbooks and special journal issues about these STP programs. SCOSTEP is an outgrowth of earlier bodies in ICSU involved in planning and implementing the International Geophysical Year (IGY: 1957-58) and the International Quiet Sun Year (IQSY: 1964-65). Completed SCOSTEP programs include: International Magnetospheric Study (IMS: 1976-79); Solar Maximum Year (SMY: 1979-81); Middle Atmosphere Program (MAP: 1982-85); and Solar-Terrestrial Energy Program (STEP: 1990-97). Four Post-STEP programs over the period 1998-2002 include: STEP-Results, Applications, and Modeling Phase (SRAMP http://www.ngdc.noaa.gov/stp/SRAMP/sramp.html); International Solar Cycle Study (ISCShttp://cspar.uah.edu/iscs); Planetary Scale Mesopause Observing System (PSMOShttp://www.hao.ucar.edu/psmos/home.html); Equatorial Processes Including Coupling (EPIChttp://www.kurasc.kyoto-u.ac.jp/%7Eepic); and Climate and Weather of the Sun-Earth System (CAWSES: 2004-2008 http://www.bu.edu/cawses/).

SCOSTEP operates as an ICSU body, its General Council providing oversight for SCOSTEP operations and participates in election of the Executive Officers. A Bureau directs scientific, administrative and financial activities. They select the Scientific Secretary who administers the Secretariat, organizes meetings, and conducts the financial business of SCOSTEP. An international group of Scientific Discipline Representatives provides advice to SCOSTEP about scientific programs and serves to link activities in their fields to our programs. They lead within SCOSTEP and through other ICSU bodies to propose new programs and participate in the Steering Committees and projects of ongoing programs. Funding for these activities comes from ICSU annual grants; annual National Adherent subscriptions; and special grants as well as from services provided by host organizations. The Scientific Secretary provides an annual audited financial statement to ICSU and the Bureau. SCOSTEP seeks opportunities for interaction with national and international programs involving STP elements. It provides guidance to the STP discipline centers of ICSU's World Data Center system. It attempts to develop and sustain student interest in Sun-Earth Connections, to promote efficient exchange of data and information between STP scientists in all countries, and to seek projects and programs that cross over traditional boundaries of physical regions and focused scientific disciplines.

http://www.ancs.ro/en

The National Authority for Scientific Research exercises the responsibilities of the state authority for research-development and carries out its activity in compliance with the provisions of the Government Ordinance No. 57/2002 on the scientific research and technological development, approved with amendments and additions by the Law No. 324/2003, with subsequent amendments.

The Authority's mission is to ensure the elaboration, application, monitoring and evaluation of the policies in the field of research-development and innovation, consistent with the strategy and the Governing Program, for the purpose of ensuring on this basis the enlargement of the national and international technological and innovation patrimony, the sustainable economic development, the access on the internal, European market and on the global markets, the creation of the informational knowledge-based society, the satisfaction of the citizens[singleQuote] needs and a growth in the quality of their lives.

The Authority has the role and responsibility:

a) to ensure the strategic and tactical planning;
b) to define the strategic and tactical objectives;
c) to define, apply, monitor and evaluate the policies necessary in order to achieve the objectives;
d) to define the normative and methodological, functional, operational and financial framework necessary to apply the policies, to follow up the harmonization of the national legislation with the legislation of the European Union and to absorb the acquis communitaire;
e) to ensure communication with the other public authorities in order to achieve a coherent approach of the government policies;
f) to ensure communication with the civil society structures and with the citizens;
g) to define, finance, apply, monitor and evaluate programs, for the purpose to achieve the objectives;
h) to stimulate the regional and local development, as well as the one in the private sector;
i) to stimulate the development of international partnership.

With a view to completing its role, the Authority exercises the following functions:

a) political - the function to present and harmonize the political viewpoint regarding the research-development and innovation field;
b) strategic - by which it strategically plans and ensures the elaboration and implementation of the policies in the field of research-development and innovation;
c) administrative - by which it forecasts, plans, assigns, monitors and evaluates the use of resources for the implementation of the policies in the field;
d) of monitoring, evaluation and control of carrying out the policies in the field of development-research and innovation;
e) of elaboration of the normative and methodological framework, functional and operational and financial framework in which the policies in the field are carried out;
f) of communication both with the other structures of the public administration and with the civil society and the citizen;
g) of international co-operation - which ensures the application of international agreements in the related field and the promotion of new agreements;
h) of state authority – which ensures the monitoring and control of the settlements in its filed;
i) of representing – which ensures, on behalf of the Government, its representation in national, regional and international bodies and organizations, as a state authority for its field.

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All the above, together with the high quality personalized services offered to its clients, recommend Atlantic Tour as an excellent partner and the best choice for all the tourists who wish to visit Romania or travel worldwide.

Atlantic Tour - Your friend and host

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