

# CAWSES Science in Russia

Report to the 3<sup>rd</sup> CAWSES Science Planning Meeting

Prepared  
by the Bureau of the  
Scientific Council on the Physics of Solar Terrestrial Connections  
("Sun – Earth" Council)  
of the Russian Academy of Sciences

[http://idg.chph.ras.ru/rus/sunearco/wmain\\_en.htm](http://idg.chph.ras.ru/rus/sunearco/wmain_en.htm)

Presented by I.S. Veselovsky

3<sup>rd</sup> CAWSES Science Planning Meeting,  
Beijing, July 23, 2006

# National CAWSES Representative

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- SCOSTEP is represented in Russia by the Scientific Council on the Physics of Solar-Terrestrial Connections (“Sun-Earth Council”) of the Russian Academy of Sciences (RAS). Prof. G.A. Zherebtsov is the Chairman of the “Sun-Earth Council” (RAS) (e-mail: [uzel@iszf.irk.ru](mailto:uzel@iszf.irk.ru)). He can be suggested to serve as the National CAWSES Representative of Russia instead of Prof. L.M. Zelenyi since 2006.

# CAWSES Teams: suggested updates

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- “Sun-Earth Council” (RAS) on its meeting of June 27, 2006 recommended following new members to be included in updated CAWSES Teams (e-mail contact via “Sun-Earth Council” (RAS) Secretary Dr. G.A. Kotova <kotova@iki.rssi.ru>) :
- **Science Steering Group:** G.A. Zherebtsov [uzel@iszf.irk.ru](mailto:uzel@iszf.irk.ru)
- (instead of L.M.Zelenyi)
- **Theme 1: Solar Influence on Climate**
- V.A. Dergachev (Ioffe Physico -Technical Institute RAS)  
[dergach@mail.ioffe.ru](mailto:dergach@mail.ioffe.ru) WG 1.1
- O.A.Troshichev (AARI) [olegtro@aari.nw.ru](mailto:olegtro@aari.nw.ru) WG 1.1
- V.A. Kovalenko (ISZF RAS) [vak@iszf.irk.ru](mailto:vak@iszf.irk.ru) WG 1.2

# CAWSES Teams: suggested updates (ctnd)

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## Theme 2: Space Weather: Science and Applications

A. A. Petrukovich (IKI RAS) [apetruko@iki.rssi.ru](mailto:apetruko@iki.rssi.ru)

E.I. Astafieva (ISZF RAS) [elliada@iszf.irk.ru](mailto:elliada@iszf.irk.ru) WG 2.1

Yu.I. Yermolaev (IKI RAS) [yermol@iki.rssi.ru](mailto:yermol@iki.rssi.ru) WG 2.2

V.N. Obridko (IZMIRAN) [obridko@izmiran.ru](mailto:obridko@izmiran.ru) WG 2.3

## Theme 3: Atmospheric Coupling Processes

A.A Krivolutsky (Central Aerological Observatoty) [alkriv@lenta.ru](mailto:alkriv@lenta.ru) WG 3.1

A.N. Lyakhov (IDG RAS) [alyakhov@idg.chph.ras.ru](mailto:alyakhov@idg.chph.ras.ru) WG 3.3

# CAWSES Teams: suggested updates (ctnd)

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## **Theme 4: Space Climatology**

I.S.Veselovsky (SINP MSU, IKI RAS) [veselov@dec1.sinp.msu.ru](mailto:veselov@dec1.sinp.msu.ru) WG 4.2

## **Capacity Building and Education**

S.A. Krasotkin (SINP MSU) [sergekras@rambler.ru](mailto:sergekras@rambler.ru)

A.N. Zaitsev (IZMIRAN) [zaitsev@izmiran.ru](mailto:zaitsev@izmiran.ru)

# Funding in 2006

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- There is no funding specifically for the CAWSES Program fulfillment in Russia.
- Part of the Russian activities in the field of Solar-Terrestrial Physics is supported by the Russian Academy of Sciences through:
  - 1) the Program #16 of the RAS Presidium “Changes of the environment and climate: natural catastrophes” - the block “Solar activity and physical processes in the Sun-Earth system” (Scientific Coordinator Prof. G.A. Zherebtsov) ~ planned 30 mln roubles to be allocated in 2006.
  - 2) the Program #16 of the RAS Division of Physical and Astronomical Sciences “Plasma processes in the Solar system” (Scientific Coordinator Prof. L.M. Zelenyi) ~ planned 8 mln roubles to be allocated in 2006.

**The Program #16 of fundamental researches by RAS Presidium  
“Solar activity and physical processes in the system Sun–Earth”  
(2005-2008)**

*Program Coordinator – Prof. G.A. Zherebtsov*

**Main scientific objectives of  
the program:**

- **Solar activity**
- **Heliosphere and cosmic rays**
- **Solar wind interaction with the magnetosphere and magnetospheric processes**
- **Interaction in the system magnetosphere–ionosphere–atmosphere–lithosphere**
- The Program is aimed to the research of various in scale processes on the Sun, in heliosphere and atmosphere of the Earth. The spectrum of the researched processes includes as relatively short-term phenomena (the most effective of which are the solar flares, coronal mass ejection and coronal holes) as also the long-term ones – 11-year and 22-year cycles, quasi-century cycles and their manifestations in the heliosphere and atmosphere of the Earth.
- 20 institutes of RAS take part (RAS, SB RAS and DVB RAS) in the Program implementation.

# Funding in 2007 and beyond

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- **Not clear. Expected at the level of 2006**
- Initiative Russian Foundation for Basic Research (RFBR) grants
- Urgent need for the international cooperation with participation and financial support of scientific workers in Russia (INTAS activity is under a danger of closing)



# **Number of participating organizations**

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**~ 15 Institutions of the Russian Academy of Sciences**

**+ Number of Universities and other Higher education organizations ~ 10**

**+ Scientific and applied organizations (few) under auspice of several ministries of the Russian Government**

# CAWSES Related Meetings and Workshops in Russia (2006)

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- 1) **“Sun-Earth Council” (RAS) Meeting**, May 19, 2006, Moscow
- 2) **“Sun-Earth Council” (RAS) Meeting**, June 27, 2006, Moscow
- 3) **PC Index Workshop**  
January 18-19, 2006  
St. Petersburg, Russia  
[olegtro@aari.nw.ru](mailto:olegtro@aari.nw.ru)
- 4) **29-th Annual Seminar “Physics of Auroral Phenomena”**  
February 27 – March 3, 2006  
Apatity, Russia  
<http://pgi.kolasc.net.ru/Seminar/>
- 5) **Jubilee Conference «Russia in Antarctica»**  
April 12-14, 2006  
St-Petersburg, Russia  
[http://www.aari.nw.ru/new\\_site/main.htm](http://www.aari.nw.ru/new_site/main.htm)

# CAWSES Related Meetings and Workshops in Russia (2006)(ctnd)

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## 6) International Workshop " Solar and Stellar Activity "

May 29-June 2, 2006

Elista, Russia

## 7) " UNIVERSAT-2006 : University Satellites and Space Science Education " - First International Symposium on Space Education

June 26-30, 2006

Moscow, Russia

<http://cosmos.msu.ru/universat2006/>

## 8) 9-th Young Scientists' Conference

"Physical Processes in Space and Near-Earth Environment "

September 11-16, 2006

Irkutsk, Russia

<http://bsfp.iszf.irk.ru/>

# CAWSES Related Meetings and Workshops in Russia (2006)(ctnd)

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**9) International Conference " Multi-Wavelength Investigations of the Sun and Modern Problems of Solar Activity"**

September 28 – October 2, 2006

Special Astrophysical Observatory, Nizhnii Arkhiz, Russia

<http://www.sao.ru/hq/sun/conf2006/index-e.html>

<http://www.sao.ru>

**10) " Days of Space Science "**

October 4-6, 2006

Moscow, Russia

<http://www.iki.rssi.ru/>

# UNIVERSAT-2006

- The conference "University Satellites and Space Science Education" (UNIVERSAT-2006) was held in Moscow on June 26-30, 2006. Over 100 scientists, teachers, educators and students from Russia, Belgium, France, USA, China, Poland, Taiwan, Armenia and Mexico took part in it. Detailed report about this conference you will find in the section "Events" and at the site UNIVERSAT-2006.
- <http://cosmos.msu.ru/universat2006/>

# IHY Steering Committee

## International Heliophysical Year 2007: “New insights into solar-terrestrial physics” (preliminary information)

- *International IHY Symposium associated with the **Sputnik 50th Anniversary Celebration** will be held in 2007 in Space Research Institute, Moscow, and related to the World Space Week.*
- *Dates: October 8-14, 2007, Moscow*
- *Local organizers:*
- *Scientific Council on the Physics of Solar Terrestrial Connections of Russian Academy of Sciences, Space Committee of Russian Academy of Sciences, Space Research Institute of RAS (IKI), Pushkov Institute for Terrestrial Magnetism, Ionosphere and Radiowave Propagation (IZMIRAN)*
- The symposium is intended for cooperation of scientists from different fields of space research: solar, heliospheric, magnetospheric, atmospheric etc. and discussion of the Sun – Earth system as an integrated complex. The International Heliophysical Year should result in development of global models of solar phenomena influence on the near–Earth environment. Such models are necessary to protect technological systems, ecology and human life itself. For this purpose, all of the available experimental data obtained by different in-situ, remote and imaging methods should be summarized, and all modeling efforts should be combined.
- The goal of the symposium is to present and discuss the first advances in International Heliophysical Year execution and to coordinate the future activities in 2008.
- **The symposium will focus on the following topics:**
- *Solar sources of geoeffective disturbances.*
- *Interplanetary medium as an energy link between the Sun and the Earth.*
- *Magnetosphere, ionosphere and atmosphere response to solar activity events.*
- *Climate, ecology and human life.*
- **Scientific Organizing Committee** (preliminary list TBD additionally) – G.A. Zherebtsov (chairman), L.M. Zelenyi (vice-chairman), V.D. Kuznetsov (vice-chairman), G.A. Kotova (scientific secretary), N.F. Blagoveshenskaya, J. Davila, N. Gopalswami, V.M. Grigoriev, V.N. Obridko, M.I. Panasyuk, A.A. Petrukovich, A.V. Stepanov, D. Webb, Yu.I. Yermolaev, Yu.I. Zetzer.
- If you wish to be added to our mailing list, please, send your name and email address to:
- Galina Kotova ([kotova@iki.rssi.ru](mailto:kotova@iki.rssi.ru)),
- Vladimir Obridko ([obridko@izmiran.ru](mailto:obridko@izmiran.ru))
- Information can be found at
- [http://idg.chph.ras.ru/rus/sunearco/wmain\\_en.htm](http://idg.chph.ras.ru/rus/sunearco/wmain_en.htm)

# **Planned International Programs/Collaborations**

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# **Selected Scientific Results**

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# Selected Scientific Results

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## Coronas-F

Two slides were provided by Prof. V.D. Kuznetsov

<http://coronas.izmiran.rssi.ru/>

<http://coronas.izmiran.ru/F/>

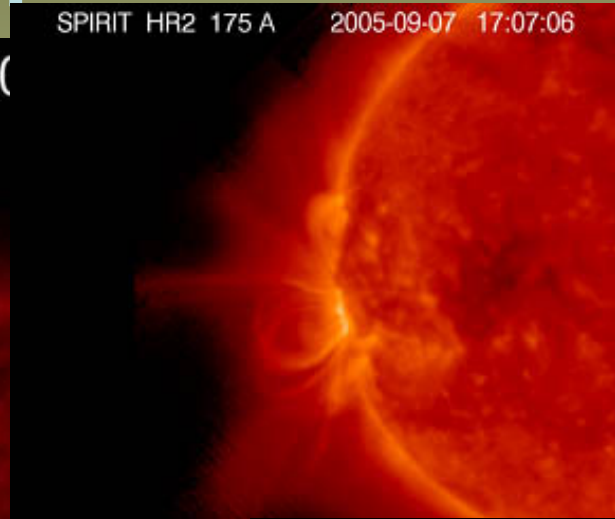
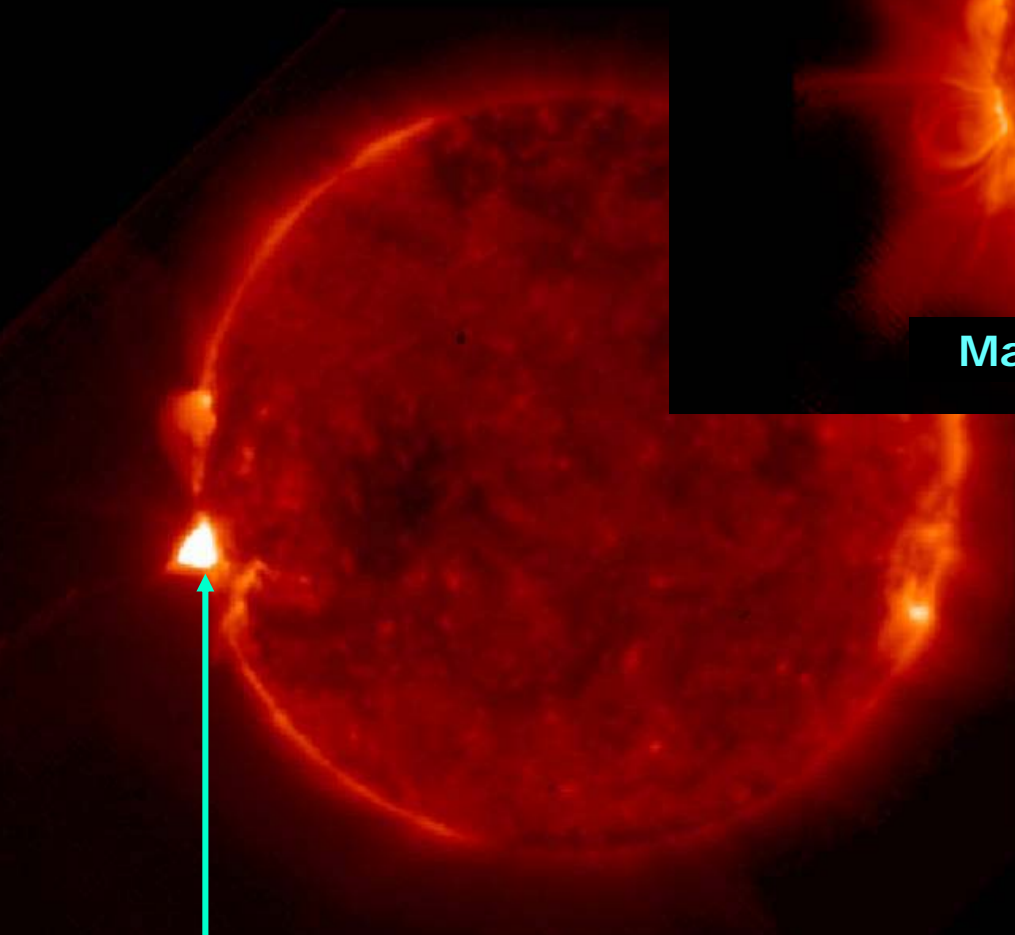
# Extreme Solar Events

## September, 2005

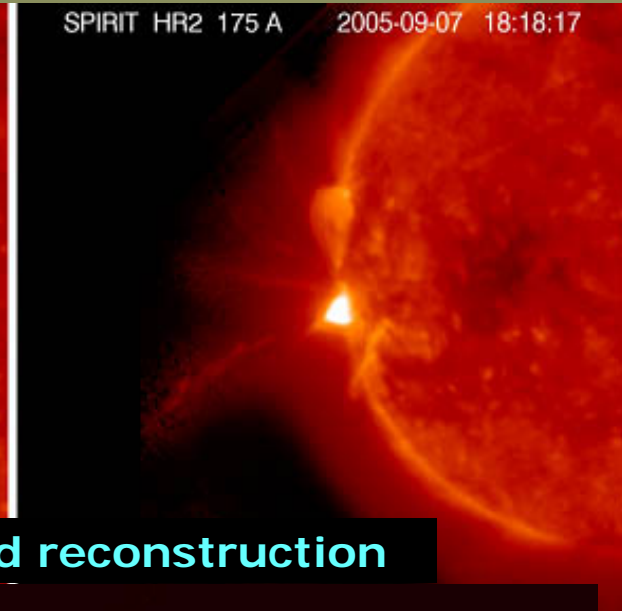
SPIRIT HR2 175 A 200

SPIRIT HR2 175 A 2005-09-07 17:07:06

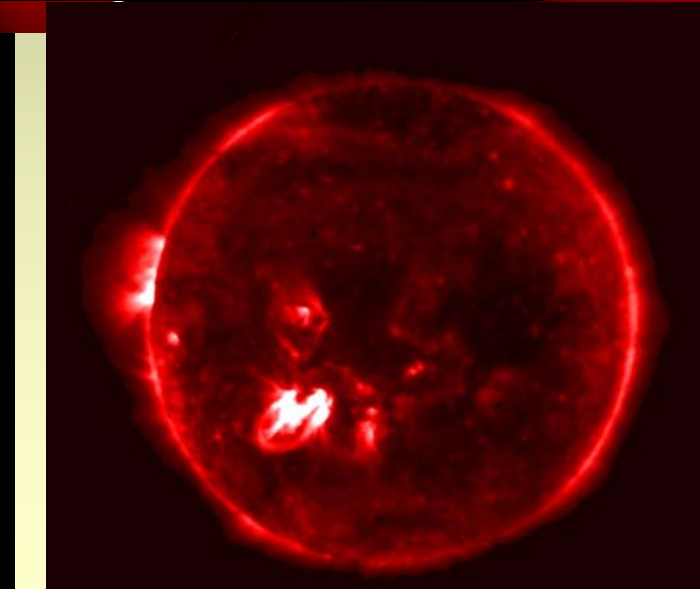
SPIRIT HR2 175 A 2005-09-07 18:18:17



Magnetic field reconstruction



September 7, 2005, Solar Flare X17.1

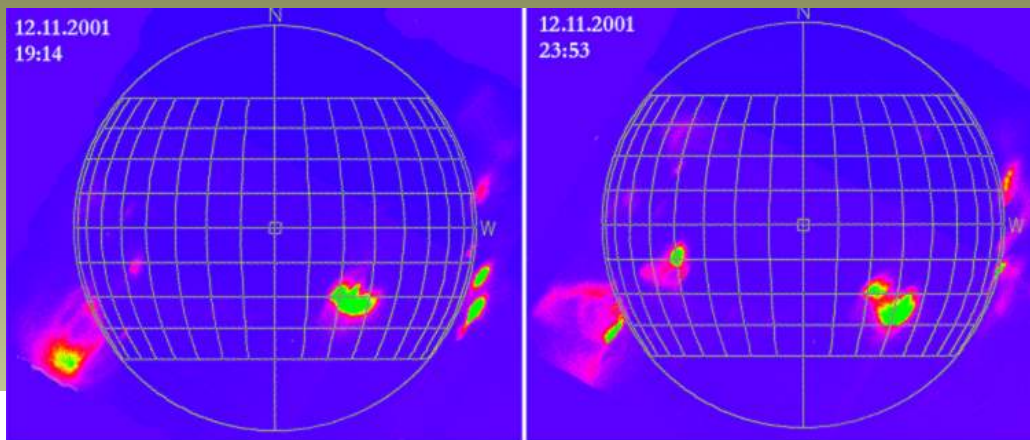


September 12, 2005, AR10808

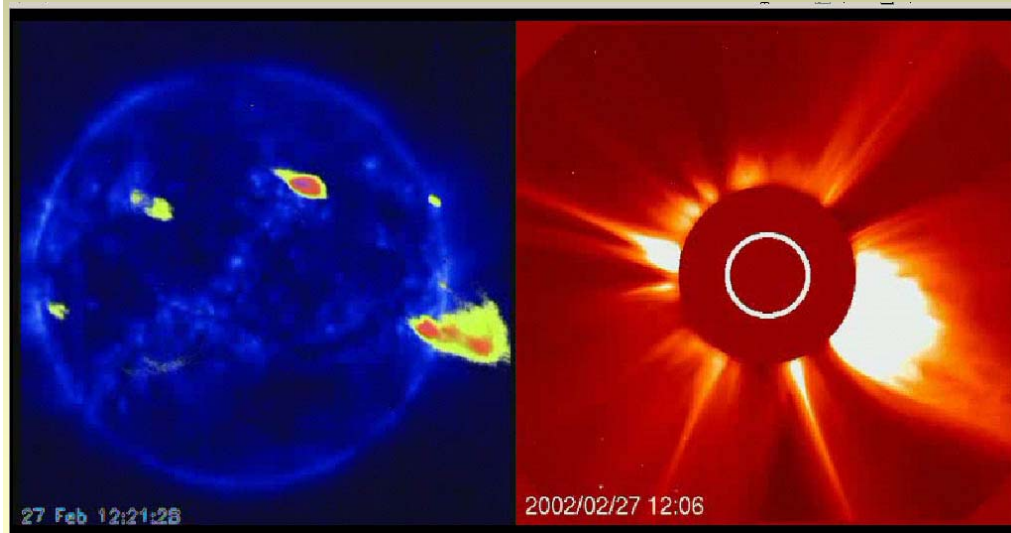
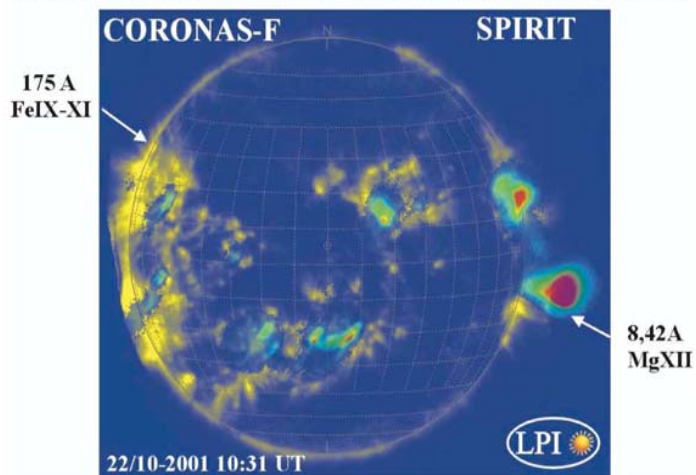
# SPIRIT Experiment

## Observations in MgXII (8,42 Å)

Hot flare plasma in the corona  
(excitation temperature up to 20 MK)



Superposition of full Sun images in 10 MK band (MgXII 8.42 Å) and in 1.6 MK band (FeIX-XI, 175 Å)



CORONAS-F/  
SPIRIT

SOHO/LASCO



# Selected Scientific Results

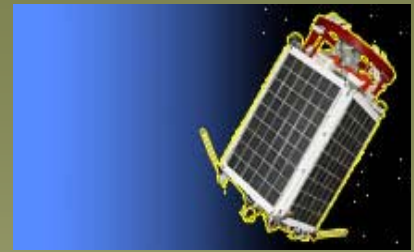
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## **“Universitetskiy –Tatiana” satellite 2005**

<http://cosmos.msu.ru/eng/>



Space Scientific and Education project  
of the Lomonosov Moscow State  
University



<http://cosmos.msu.ru/eng/>

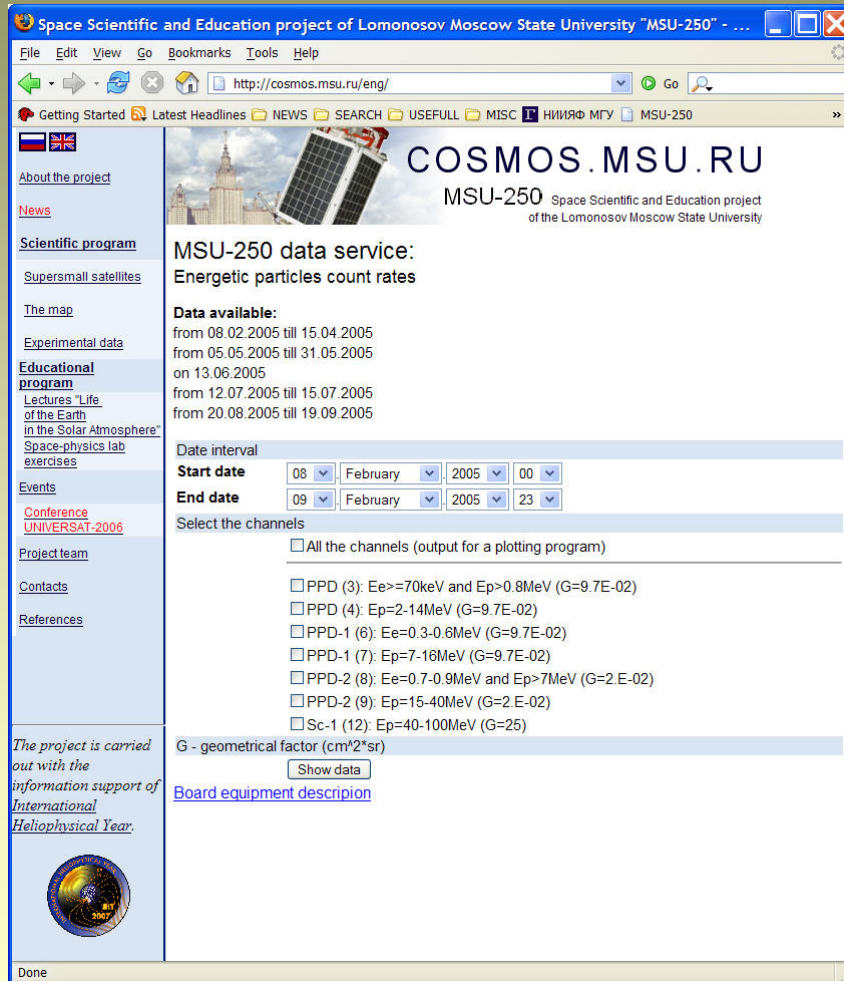
<http://cosmos.msu.ru/universat2006/>

- **“Universitetskiy –Tatiana” satellite 2005:**

- **Data and information available at the site** <http://cosmos.msu.ru/eng/>
- **1.Polar cap** 1.Forbush-effect of galactic cosmic rays (GCR). 2.Latitudinal effect of GCR. 3.Flare increases of solar cosmic rays (SCR). 4.Dynamics of the SCR's penetration boundaries. 5.Topology of remote regions of the magnetosphere.
- **2.Auroral region** Dynamics of the auroral region boundaries by means of observation of:– electrons with energy of  $\sim 1$  keV; –electrons with energy of  $>70$  keV; –SCR protons with energy of  $\sim 1$  MeV; –atmospheric glow at  $\lambda = 3914\text{\AA}$ .
- **3.Outer radiation belt** 1.Studies of the outer belt structure under the quiet and disturbed geomagnetic conditions. 2.Studies of injection of electrons with energy of  $<300$  keV. 3.Studies of injection mechanism of relativistic electrons ( $E_e > 1$  MeV) during the geomagnetic storms. 4.Studies of electrons precipitation processes.
- **4.Inner radiation belt** 1.Studies of spatial distribution of high-energy protons. 2.Determination of the top boundary of relativistic electrons' fluxes. 3.Studies of the role of resonance mechanisms in the acceleration of high-energy electrons.
- **5.Studies of UF variations** 1.Aurora borealis and other atmospheric glows, caused by charged particles fluxes, penetrated into the Earth's atmosphere. 2.Atmospheric glow during electric discharges. 3.Meteors' glowing. 4.Measurments of UF glowing background in the atmosphere.



# Launch and Data Base



Space Scientific and Education project of Lomonosov Moscow State University "MSU-250" - ...

File Edit View Go Bookmarks Tools Help

http://cosmos.msu.ru/eng/

Getting Started Latest Headlines NEWS SEARCH USEFULL MISC НИИЯФ МГУ MSU-250

**COSMOS.MSU.RU**  
MSU-250 Space Scientific and Education project of the Lomonosov Moscow State University

**MSU-250 data service:**  
**Energetic particles count rates**

**Data available:**  
from 08.02.2005 till 15.04.2005  
from 05.05.2005 till 31.05.2005  
on 13.06.2005  
from 12.07.2005 till 15.07.2005  
from 20.08.2005 till 19.09.2005

Date interval

**Start date** 08 February 2005 00

**End date** 09 February 2005 23

Select the channels

All the channels (output for a plotting program)

PPD (3):  $E_e \geq 70 \text{ keV}$  and  $E_p > 0.8 \text{ MeV}$  ( $G=9.7E-02$ )

PPD (4):  $E_p = 2-14 \text{ MeV}$  ( $G=9.7E-02$ )

PPD-1 (6):  $E_e = 0.3-0.6 \text{ MeV}$  ( $G=9.7E-02$ )

PPD-1 (7):  $E_p = 7-16 \text{ MeV}$  ( $G=9.7E-02$ )

PPD-2 (8):  $E_e = 0.7-0.9 \text{ MeV}$  and  $E_p > 7 \text{ MeV}$  ( $G=2.E-02$ )

PPD-2 (9):  $E_p = 15-40 \text{ MeV}$  ( $G=2.E-02$ )

Sc-1 (12):  $E_p = 40-100 \text{ MeV}$  ( $G=25$ )

G - geometrical factor ( $\text{cm}^2 \cdot \text{sr}$ )

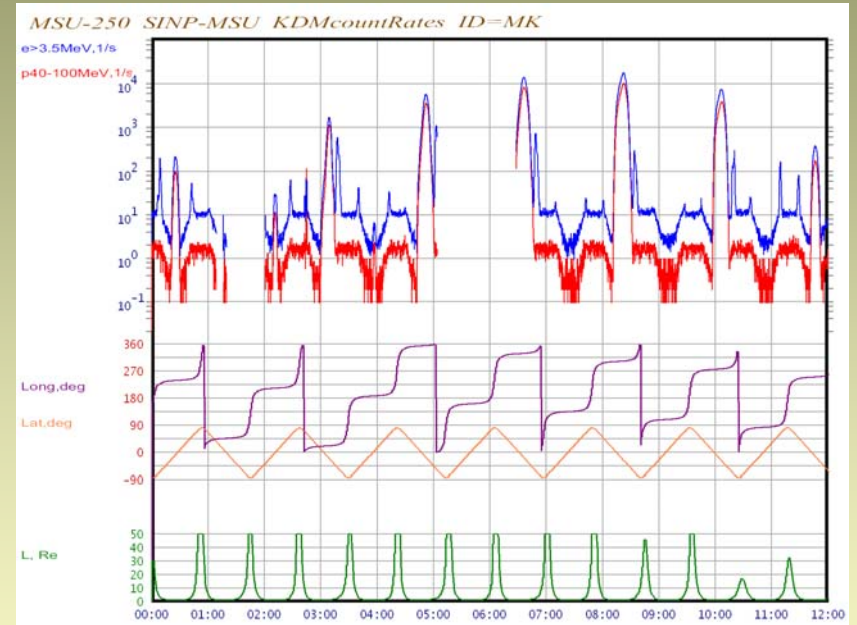
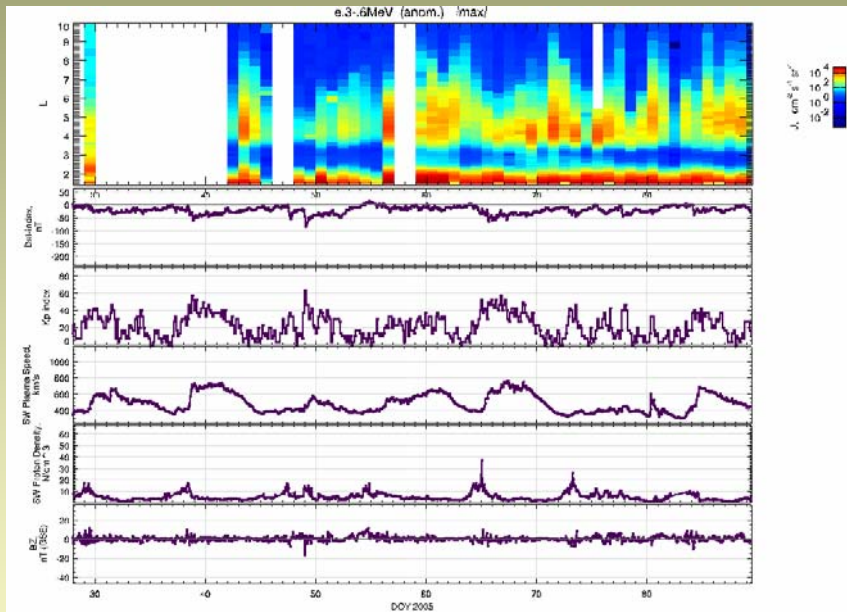
Show data

[Board equipment description](#)

Done



# Sample data representation: Radiation Belt Dynamics



# **Selected Scientific Results (ctnd)**



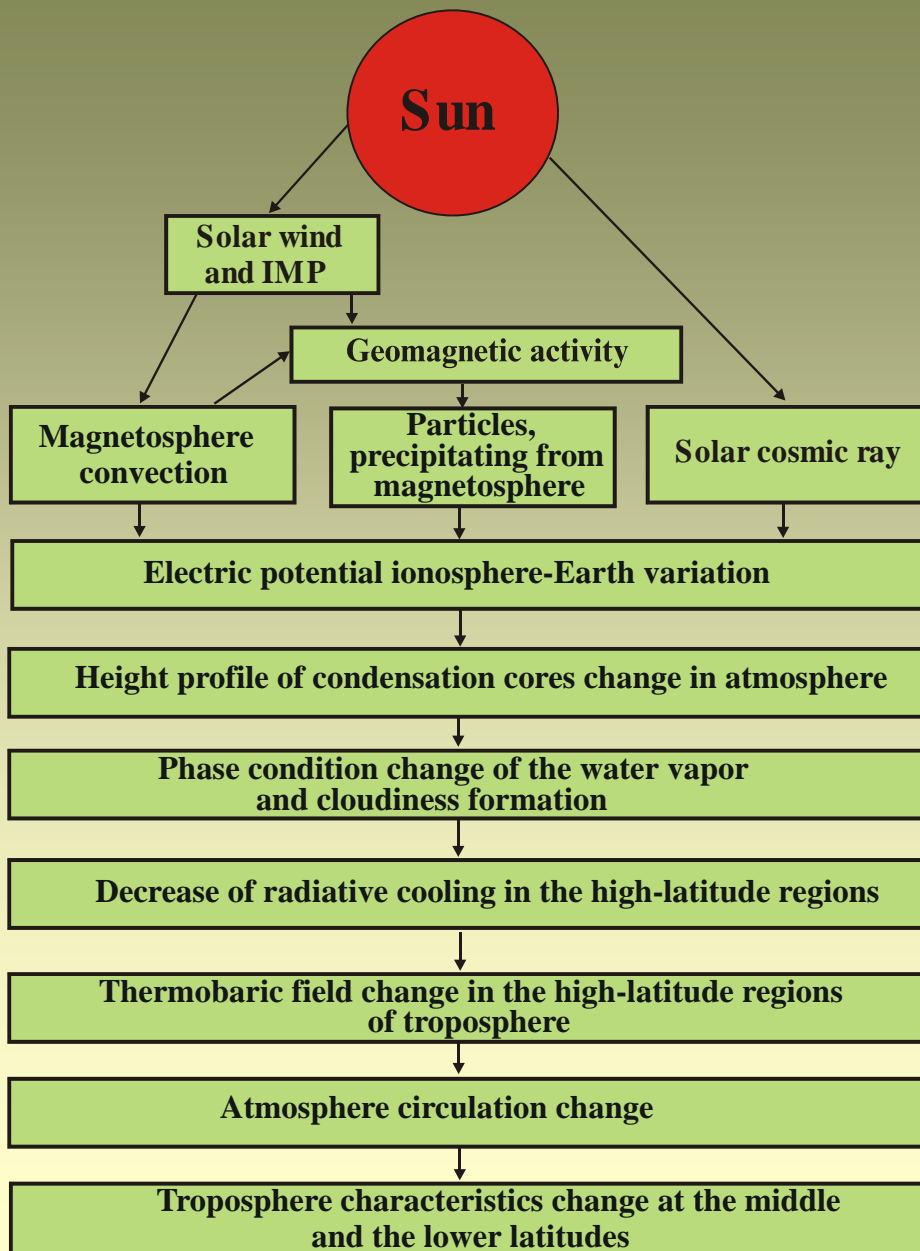
# Investigation of the Mechanisms of the Solar Influence on the Earth's Troposphere

( Three slides were provided by the authors of the work:  
The physical mechanism of the solar variability influence on electrical and  
climatic characteristics of the troposphere,  
[Zherebtsov, G. A.](#); [Kovalenko, V. A.](#); [Molodykh, S. I.](#) Advances in Space  
Research, Volume 35, Issue 8, p. 1472-1479, 2005)

- **The physical mechanism for solar activity influence on the climate characteristics of the Earth's troposphere is proposed.**
- **The new concept and the model of this influence are worked out.**

The model key concept – solar activity influences on the Earth's climate system parameters regulating the energy flux coming from the Earth into space in the high-latitude regions. Energy quantity necessary for such influence can be quite small. The connecting link between the solar activity and the troposphere characteristics is the atmosphere electricity. On the one hand, difference of the electric potential ionosphere-Earth in the polar regions sufficiently depends on the solar wind, interplanetary magnetic field parameters and solar cosmic ray flux, and on the other hand it sufficiently influences the radiation balance in definite regions of the high-latitude atmosphere influencing the distribution of charged condensation cores in atmosphere. Володя! Вставь, пожалуйста

➤ Model of solar activity interaction with the troposphere and the climate system parameters is being worked out



## Block-scheme of the model

Peculiarities of the atmosphere response to the solar activity influence expected from the model:

1. Maximal response in the troposphere thermo-baric characteristics should be expected in the high-latitude regions because just here the sufficient increase of the electric potential Earth-ionosphere is observed during the heliogeophysical disturbances.
2. As for the individual events and for the long-term trend the opposite changes of temperature should be expected in the lower and the upper troposphere.
3. The response is greatly expressed in local winter when the incoming short wave flux is small or it is absent.
4. We should expect the response dependence on the day time (maximal manifestation at night), minimal air temperatures increase.

## ➤ Results of the study of peculiarities of the troposphere thermo-baric characteristics changes: expected from the model and observed

- It is found that the solar cosmic ray invasion and geomagnetic disturbances is followed by a change of the typical zonal transportation, which manifests itself in the emergence of «stationing» of certain moving structures.
- It is found that after heliogeophysical disturbances in separate high-latitude regions of lower and middle troposphere an increase up to  $15^{\circ}$  is observed when at the same time in the upper troposphere the temperature decrease is observed.
- The amplitude of the surface air temperature long-term changes is increasing with the latitude and it is maximal over the land.
- The largest surface air temperature increases are observed for the night (minimal) temperatures of local winter.
- Singled out regularities totally correspond to the expected ones from the worked out model of solar activity influence on the troposphere climate characteristics.
- Quantitative estimation of solar activity contribution into the heat content change of the Earth climate system is carried out on the basis of the represented model. It is shown that during the long-term periods with the high level of solar activity there happens the decrease of the energy losses by the Earth climate system and its heat content is increasing.

# Extended time series of Solar Activity Indices (ESAI)

Contact address: [nag@gao.spb.ru](mailto:nag@gao.spb.ru) (Dr. Yury Nagovitsyn)  
Russian Academy of Sciences, Central astronomical observatory at Pulkovo,  
Pulkovskoe shosse, 65/1, Saint-Petersburg, 196140,  
Russia

## Extended time series of Solar Activity Indices (observational, synthetic and simulated data)

[→ Readme](#)

[→ GRAPHICS](#)

→ ASCII FILES

– *Observational sets*

- ◆ [monthly sunspot areas \(Greenwich general system\), 1821-1989](#)
- ◆ [yearly sunspot areas \(Greenwich general system\) for N- and S- hemispheres, 1821-1994](#)
- ◆ [yearly mean latitudes of sunspots for N- and S- hemispheres, 1854-1985](#)

– *Synthetic set*

- ◆ [yearly polar faculae numbers \(Mt. Wilson general system\) for N- and S- hemispheres, 1837-1999](#)

– *Simulated sets*

- ◆ [yearly Wolf numbers \(Zurich-International general system\), 1090-2002](#)
- ◆ [yearly polar faculae numbers \(Mt. Wilson general system\), 1705-1999](#)

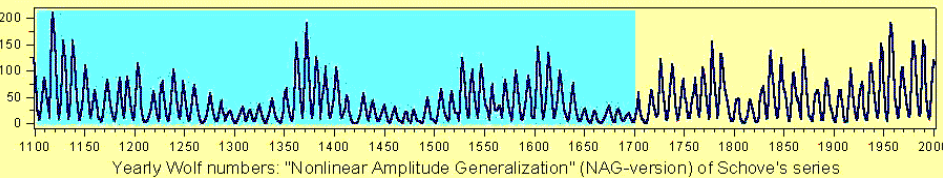
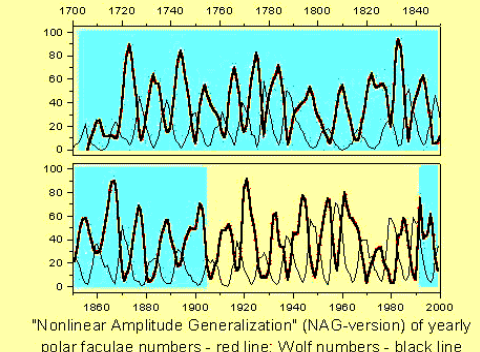
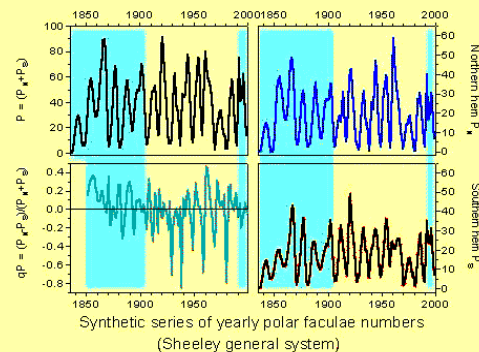
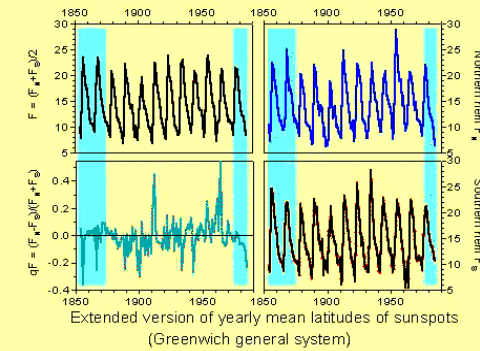
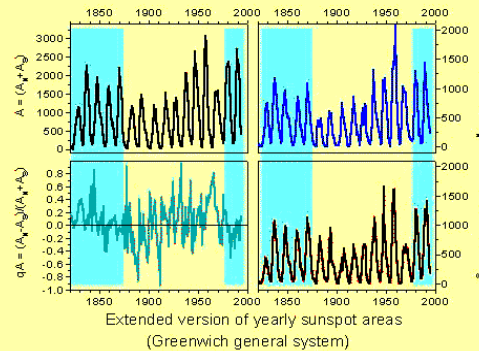
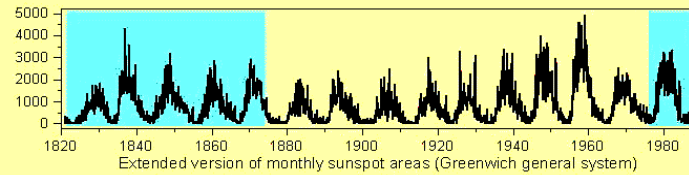


Supported by grants:

INTAS 2000-0752 "Key parameters of Space Weather",  
INTAS 2001-0550 "The Solar-terrestrial climate link in the past millennia and its influence on future climate",  
and partly – Federal Scientific and Technical Program "Astronomy-1105",  
Program of Presidium of Russian Academy of Sciences "Non-stationary phenomena in astronomy",  
Program Division for Physical Sciences of RAS No 16 "Solar Wind",  
and Russian Fund for Basic Researches No 01-07-90289.

# Extended Time Series of solar activity indices ESAI

**Ref: Nagovitsyn Yu.A.,  
Ivanov V.G., Miletsky E.V.,  
and Volobuev D.M.  
ESAI Database and Some  
Properties of Solar Activity  
in the Past. -  
Solar Physics, 224, 2005.**



# Two-hundred-year solar cycle (de Vries cyclicity) in climatic changes

- Climate response to de Vries solar cycles: evidence of *Juniperus turkestanica* tree rings in Central Asia
- **Authors:**  
[Raspopov, O.](#); [Dergachev, V.](#); [Kozyreva, O.](#); [Kolström, T.](#)
- **Affiliation:**  
AA(SPbF IZMIRAN, P.O. Box 188, 191023, St.Petersburg, Russia; oleg@OR6074.spb.edu), AB(Ioffe Physico-Technical Institute, RAS, St.Petersburg, Russia), AC(Institute of Physics of the Earth, RAS, Moscow, Russia), AD(Mekrijärvi Research Station, University of Joensuu, Finland)
- **Publication:**  
Memorie della Societa Astronomica Italiana, v.76, p.760 (2005)
- **Abstract**
- A manifestation of the two-hundred-year solar cycle (de Vries cyclicity) in climatic changes is considered. The consideration is based on analysis of radial growth of long-lived (800-1200 years) trees *Juniperus turkestanica* from Tien Shan mountains (Central Asia). Quasi-two-hundred-year oscillations in radial tree growth which correlate well (correlation coefficient is 0.82) with similar solar activity variations ( $\Delta 14C$ ) and the 200-year component of temperature variations in the Northern Hemisphere in the last millenium and also with quasi-two-hundred-year variations in climatic processes in Europe, North and South America, and Asia have been revealed. The results obtained point to the influence of the deVries solar activity periodicity on global climatic processes.

