

# INFORMATION ABOUT THE WORLD DATA CENTERS FOR SOLAR-TERRESTRIAL PHYSICS AND SOLID EARTH PHYSICS, REGIONAL MULTIDISCIPLINARY INITIATIVES OF THE RUSSIAN-UKRAINIAN WORLD DATA CENTERS SEGMENT FOR OCCURRENCE IN THE WORLD DATA SYSTEM

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## ABSTRACT

*The Russian World Data Center for Solar-Terrestrial Physics and the World Data Center for Solid Earth Physics have been collecting, analyzing, archiving, and disseminating data and information on a wide range of geophysical disciplines since the International Geophysical Year 1957-1958. The centers provide free and convenient access for users to their large and permanently increasing volumes of data. Russian WDCs participate in scientific national and international programs and projects, such as InterMAGNET, InterMARGINS, and the International Polar Year. Since 2008 there has been an association of five Russian WDCs and one Ukrainian WDC in a regional segment of the World Data Centers.*

**Keywords:** WDC, Geophysics, Russian-Ukrainian Segment, Data storage, Data access

## 1 INTRODUCTION

The World Data Center for Solar-Terrestrial Physics (WDC for STP) and the World Data Center for Solid Earth Physics (WDC for SEP) in Moscow, Russia perform a permanent job to include new geophysical data sets to the global distributed network information resources and provide remote access for users to solar-terrestrial and solid Earth physics data. Digital data, metadata, thematic and problem oriented databases, and inventory catalogues for all disciplines are available online at the WDCs' web sites. Special user interface provides a comfortable means for finding, reviewing, visualizing, and retrieving online data and assigning them to a user.

The WDC for STP, Moscow was established in 1957 within the framework of the International Geophysical Year 1957-1958. The WDC for SEP, Moscow has existed since 1971. Both are hosted by the Geophysical Center of the Russian Academy of Sciences (GC RAS) and are incorporated into the Laboratory of Geophysical Data. GC RAS is a public institution that receives funds from the Russian Federation through the Russian Academy of Sciences.

The main functions of the centers according to the "Guide to the WDC System" are to collect, manage, and archive geophysical data on the underlying principles of long-term secure preservation, assurance of the quality of scientific data, and provision of free and open access to all data for scientific research.

The WDCs for STP and SEP store and disseminate national and foreign multidisciplinary data. The information resources of the WDCs include modern and historical results of global observations related to a wide range of geophysical disciplines obtained during the International Geophysical Year and subsequent international projects, results of geophysical observations on global observation networks and during special experiments and expeditions.

Along with providing access to data stored in their archives, the WDCs serve as an information and reference node offering links for information on other data centers and data providers that possess interesting data sets and databases. The centers are targeted by scientific organizations, separate researchers, universities, and students in different fields of science both in Russia and abroad.

## 2 RUSSIAN WORLD DATA CENTERS FOR SOLAR-TERRESTRIAL PHYSICS AND SOLID EARTH PHYSICS

### 2.1 WDC for Solar Terrestrial Physics, Moscow

The activities of the WDC for Solar Terrestrial Physics, Moscow extend to the following disciplines:

- *Solar Activity and Interplanetary Medium*: sunspot areas and classifications, solar indices, optical observations, magnetic fields, X rays and UV radiation, energetic protons and electrons, proton bursts, solar wind density and velocity, electric and magnetic fields
- *Geomagnetic Variations*: magnetic variations, pulsations, magnetosphere boundaries
- *Ionospheric Phenomena*: ionospheric vertical soundings, radioactive absorption, radio interference, flare associated events
- *Cosmic Rays*: solar and galactic neutrons, mesons
- Summaries of separate kinds (individual types) of data and of results of special data analyses or processing (solar proton events, catalogues of geomagnetic storms, etc.)

Solar-terrestrial physics data are available in the form of printed tables and analog and electronic records. Printed tables and analog records are stored on paper and on microfilms and microfiches. The WDC for STP converts printed tables and analog records into electronic form by scanning them or copying them with a digital camera. Data in electronic form are stored on CDs, DVDs, and hard disks and are transformed into international formats whenever possible. The Center ensures their continuing free access. Solar-terrestrial physics data are distributed either through the online access to the WDC's web site (<http://www.wdcb.ru/stp/index.en.html>) (Figure 1) or through the Space Physics Interactive Data Resource (SPIDR) (<http://clust1.wdcb.ru/spidr/>). Users can also receive data by request.

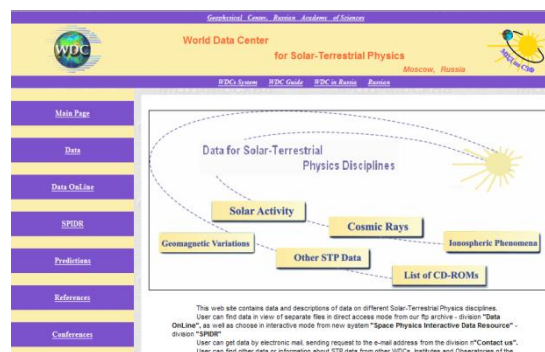


Figure 1. Main page of the WDC for Solar-Terrestrial Physics web site

All standard data of the world's geomagnetic observatories network, geomagnetic indexes, ionospheric data, cosmic ray data, solar data, etc., stored in the WDC for STP, are accessible on the Moscow SPIDR web site and mirrored worldwide by SPIDR sites in Boulder, Paris, Nagoya, Sydney, Beijing, Kiev, and Capetown. The SPIDR is designed to allow a solar terrestrial physics customer to intelligently access and manage historical and modern space physics data for integration with environment models and space weather forecasts. SPIDR is a distributed network of synchronous databases, web portals, and web services, allowing users to choose, visualize, and model data on solar-terrestrial physics on the Internet.

Additional solar-terrestrial data in non-standard formats are available on the web site of the WDC for STP. They include data from magnetic observatories in Russia and the former Soviet Union: hourly-mean values for 38 observatories mainly since the IGY (1957); one-minute values from 41 observatories mainly since 1983; global magnetic activity indices (*aa*, *Kp*, *Ap*, *AE*, *Dst*, *Pc*, etc.); digital images of magnetograms beginning in 1957; sudden commencement readings since 1868; and a catalogue of geomagnetic Pc1 pulsations at the Borok and Mirny observatories for the period 1957-1992.

### 2.2 WDC for Solid Earth Physics, Moscow

The World Data Center for Solid Earth Physics, Moscow collects and maintains archives of data on geophysical disciplines:

- *Seismology*: wave forms (seismograms), phase data (seismological bulletins), hypocenter data (earthquake catalogues), focal mechanisms, and seismological special data bases.
- *Magnetic Measurements (main magnetic field)*: marine surveys, maps and analytical models of the magnetic field, annual mean values of the magnetic field elements, secular variations.

- *Gravimetry*: marine surveys, measured values of the Earth's gravity field, maps of the gravity field and its anomalies, satellite data.
- *Heat flow*: catalogues of measured heat flow values, maps of heat flow isolines.
- *Archeo- & Paleomagnetism*: data catalogues.
- *Recent Movement*: data catalogues.

All data are available in different traditional (paper, microfilms, and microfiche) and electronic (separate files and databases) forms on various media. The archive is formed according to the disciplines and types of observations. Each section of the archive contains data represented in the form of tables, descriptions, maps, publications, graphic records (seismograms). All data are registered in the computer database and listed in the data inventory catalogues, which are free accessible on the web site <http://www.wdcb.ru/sep/> (Figure 2). Every data set is accompanied by metadata, detailed documentation, and format description. Each new dataset is analyzed, and its quality control is provided by means of special computer programs. All received datasets are stored in their initial form, and two reserve copies of data are prepared as an indispensable condition.

These data contain the results of observations made not only since 1957. Many historical data for earlier time periods are stored in the WDC for SEP. In order to expand the existing electronic geophysical data resources and also for prevention of loss of the old data, the conversion of old data available in the form of publications into digital electronic form and providing network access to these data is realized.

Users of the WDC for Solid Earth Physics are provided with data in the form of copies of data on paper carriers, CDs with data in electronic form, and online on the web site. Any user can contact and get a consultation with WDC specialists by email or phone.

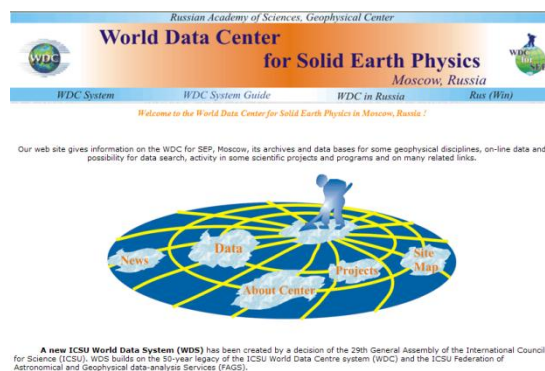


Figure 2. Main page of the WDC for Solid Earth Physics web site

### 3 INVOLVEMENT OF RUSSIAN WORLD DATA CENTERS IN INTERNATIONAL PROJECTS

Russian WDCs participate in scientific national and international programs and projects. The WDC for STP took part in the ICSU "The Rescue of the Magnetograms" project that resulted in digital images of magnetograms from nine observatories of the former Soviet Union covering over 100 observatory-years of valuable data. Now the WDC for Solar-Terrestrial Physics is involved in the modern research project "InterMAGNET" in the part concerning the Earth's magnetic field information technologies and data management. The WDC for Solid Earth Physics is a participant in the international and interdisciplinary project "InterMARGINS" that is concerned with all aspects of continental margin research.

Both centers were active participants in the "International Polar Year 2007-2008", working in two programs "IPY Data and Information Service for Distributed Data Management – IPY DIS" and "Dataware for Geophysical Research for carrying out of International Polar Year". The main output of the implementation of these programs was the creation of the special web site containing results of various geophysical observations in the Arctic and Antarctic regions carried out in the Former Soviet Union and then in Russia from 1957 up to the present and stored in the archives of both centers (<http://www.wdcb.ru/WDCB/IPY/IPY.html>) (Figure 3). Some historical data, for example geomagnetic measurements at drifting stations "North Pole", has been converted into electronic form especially for this site. The site is permanently supplemented by new data. Along with this, the centers have participated in the creation of the Russian IPY-Info Portal, which is an integrated high-quality multidisciplinary information system that includes a metadata base, databases, and systems of data collection, communication, and data storage. The Russian IPY-Info Portal serves as a component of the International Portal

“IPY Data and Information Service – IPYDIS”. The metadata circulate in a system of data gathering, storage, exchange, and processing at international and national levels.



**Figure 3.** Access page to Arctic geomagnetic data of the IPY web site

## 4 RUSSIAN-UKRAINIAN WORLD DATA CENTERS SEGMENT

In 2008 five Russian WDCs (for Oceanography, Meteorology, Rockets, Satellites and Rotation of the Earth, Solar-Terrestrial Physics and Solid Earth Physics) and the Ukrainian WDC (for Geoinformatics and Sustainable Development) united in the regional Russian-Ukrainian Segment of World Data Centers. The scientific council for coordination of the segment’s activity was formed.

Since 2009 two joint Russian-Ukrainian projects, aimed at development and strengthening of the segment and creation of common information space, supported by the Russian Foundation for Basic Research and the Fundamental Researches State Fund of Ukraine, have been implemented.

For efficient storage and process of data and to provide users with free and convenient access, the general distributed multidisciplinary information-analytical system was developed in the framework of the segment.

The WDCs entering into the Russian-Ukrainian Segment aspire to create a common information space with a uniform multidisciplinary data catalogue, uniform metadata base, and single access point into the segment.

The Russian and Ukrainian WDCs are developing an integrated access to the common information resources of the segment. The system will include a complete distributed multidisciplinary base of metadata, a catalog of multidisciplinary information resources, and access services – a system of analytical modules, based on different methods of interactive data processing and providing free remote access to data.

## 5 CONCLUSION

The WDCs for STP and SEP recently have passed all necessary procedures and have become regular members of the World Data System. The centers hope that their data archives and information resources will serve as a considerable contribution to the development of the World Data System. The further consolidation and solidifying of the Russian-Ukrainian Segment of WDCs and creation of its common information space will serve for further improvement of data management and provide strong connections and more intensive communications among WDS participants for the goal of free and convenient sharing and accessibility of science data and knowledge.

## 6 REFERENCES

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