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

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ABSTRACT

Russian World Data Center for Solar-Terrestrial Physics and World Data Center for Solid Earth Physics collect, analyze, archive and disseminate data and information on a wide range of geophysical disciplines starting from the International Geophysical Year 1957-1958 up to present. The Centers provide free and convenient access for users to the great and permanently increasing volumes of data. Russian WDCs participate in the scientific national and international programs and projects such as InterMAGNET, InterMARGINS, International Polar Year. Since 2008 there is 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 World Data Center for Solid Earth Physics (WDC for SEP) in Moscow, Russia, perform a permanent job on inclusion of new geophysical data sets to the global distributed network information resources and provide the remote access for users to solar-terrestrial and solid Earth physics data. Digital data, metadata, thematic and problem oriented databases, inventory catalogues for all disciplines are available online at the WDCs web sites. Special user interface provides comfortable means for finding, reviewing, visualization, and retrieval of the online data and assignment 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, exists 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. Information resources of WDCs include modern and historical results of global observations related to the wide range of geophysical disciplines, obtained during the International Geophysical Year and subsequent international projects, results of geophysical observations on global observing networks and during special experiments and expeditions.

Providing access to data saved up in their archives, the WDCs besides serve as an information and reference node offering links for the information on other data centers and data providers which possess interesting data sets and databases. The Centers are targeted on the scientific organizations, separate researchers, universities and students in the different fields of sciences 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

WDC for Solar Terrestrial Physics, Moscow, activity extends to 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 on separate kinds (individual types) of data and on 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, analog records and electronic. Printed tables and analog records are stored on paper and on microfilms and microfiches. WDC for STP realizes converting of printed tables and analog records into electronic form by scanning them or copying by the digital camera. Data in electronic form are stored on CD, DVD and Hard disks and are transformed into international formats whenever possible. The Center ensures persistent free access to them. 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/*). User can also receive data by request.

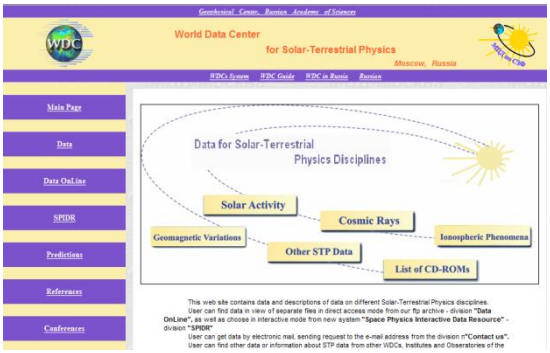

Figure 1. Main page of the WDC for Solar-Terrestrial Physics web site

All standard data of the world 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 to choose, visualize and model data on the solar-terrestrial physics in 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 from 1957; sudden commencement readings since 1868; and catalogue of geomagnetic Pc1 pulsations at the Borok and Mirny observatories for the period 1957-1992.

2.2 The World Data Center 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 gravity field, maps of 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. 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 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 converting of old data available in the form of publications into digital electronic form and providing the network access to these data is realized.

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

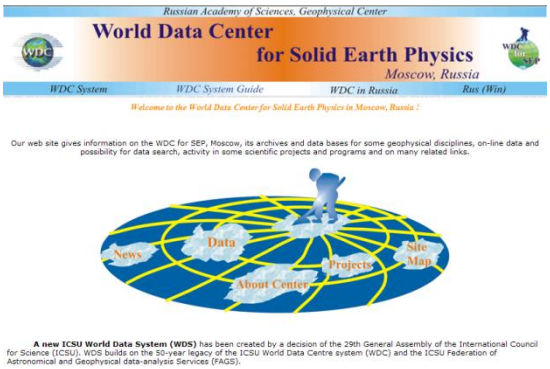

Figure 2. Main page of the WDC for Solid Earth Physics web site

3 INVOLVEMENT OF RUSSIAN WORLD DATA CENTERS INTO INTERNATIONAL PROJECTS

Russian WDCs participate in the scientific national and international programs and projects. The WDC for STP took part in the ICSU "The Rescue of the Magnetograms" project 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 magnetic field information technologies and data management. WDC for Solid Earth Physics is the participant of the international and interdisciplinary project "InterMARGINS" concerned all aspects of continental margin research.

Both Centers were the active participants of 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". Main output of implementing these programs was creation of the special web site containing results of various geophysical observations in Arctic and Antarctic regions carried out in the Former Soviet Union and then in Russia from 1957 up to present and stored in 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 in electronic form specially for this site. The site is permanently supplemented by new data. Besides that the Centers participated in creation of Russian IPY-Info Portal which is an integrate high-quality multidisciplinary information system with

included metadata base, databases, systems of data collection, communication and data storage. Russian IPY-Info Portal serves as the component of the International Portal "IPY Data and Information Service – IPYDIS". Metadata circulate in a system of data gathering, storage, exchange and processing at international and national levels.

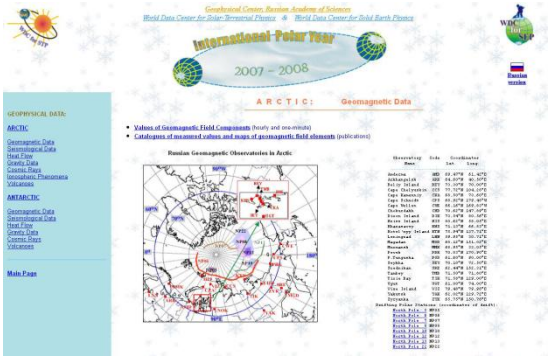

Figure 3. Access page to Arctic geomagnetic data of IPY web site

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) have united in the regional Russian-Ukrainian Segment of World Data Centers. The Scientific Council for coordination of 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, are being implemented.

For efficient storage and process of data and providing users with free and convenient access to them the general distributed multidisciplinary information-analytical system is developed in the framework of the Segment.

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

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

5 CONCLUSION

WDCs for STP and SEP recently have passed all necessary procedures and became regular members of the World Data System. The Centers hope that their data archives and information resources will serve as the 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 providing 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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