

WORLD DATA CENTER FOR GEOINFORMATICS AND SUSTAINABLE DEVELOPMENT: STATE-OF-THE-ART

Alexei Gvishiani¹, Michael Zgurovsky², Vitaliy Starostenko³, Kostiantyn Yefremov⁴, Alexei Pasichny⁵ and Nataliya Sergeeva⁶

¹ *Geophysical Center of RAS, 3, Molodezhnaya Str., 119296, Moscow, Russia, gvi@wpcb.ru*

² *National Technical University of Ukraine "Kyiv Polytechnic Institute", 37, Peremohy ave., 03056, Kyiv, Ukraine, zgurov@zgurov.kiev.ua*

³ *Institute of Geophysics of NAS of Ukraine, 32 Palladin ave., 03680, Kyiv, Ukraine, secretary@igph.kiev.ua*

⁴ *National Technical University of Ukraine "Kyiv Polytechnic Institute", 37, Peremohy ave., 03056, Kyiv, Ukraine, k.yefremov@gmail.com*

⁵ *National Technical University of Ukraine "Kyiv Polytechnic Institute", 37, Peremohy ave., 03056, Kyiv, Ukraine, alexis.pasichny@gmail.com*

⁶ *Geophysical Center of RAS, 3, Molodezhnaya Str., 119296, Moscow, Russia, nata@wpcb.ru*

ABSTRACT

The important part of any modern scientific research is on the one hand scientific data accessibility and reliability and on the other one – integration of different scientific research teams for the joint solving of global problems. World data center system is the best solution for such activities. World data center for geoinformatics and sustainable development was organized in National technical university of Ukraine “Kyiv polytechnic institute”. Its main priorities for today are creation and implementation of additional user-friendly software tools, which would make possible to unify the receiving, storing, processing and transiting data.

Keywords: world data system, Ukraine, NTUU “KPI”, world data center, geoinformatics, sustainable development.

1 INTRODUCTION

Ukrainian branch of the World data center (WDC) for Geoinformatics and & Sustainable Development is situated in the educational-scientific complex "Institute for applied systems analysis" (ESC "IASA") of the National academy of sciences (NAS) of Ukraine and Ministry of education and science of Ukraine in the structure of the National technical university of Ukraine the "Kyiv polytechnic institute" (NTUU "KPI"), Kyiv, Ukraine.

2 CREATION OF THE UKRAINIAN BRANCH OF WORLD DATA CENTER

Ukraine was brought over to the processes of global data collection in the days of creation two first WDCs, as one of the largest soviet republics with plenty of outstanding scientific institutions. Considerable part of work on collection and preparation of data was executed in the specialized academic establishments of the all USSR, which then passed information to WDC B. With disintegration of the USSR and appearance of new countries, during 90s there was a problem of Ukrainian scientists' isolation from the world scientific community: previous connections with partners on scientific data exchange were weakened, and new ones were not set.

Ukraine is a young state which from the beginning of the existence should solve the thorny problem of liquidation of consequences of failure on Chernobyl' nuclear power plant. The solution of whole spectrum of problems drew attention of scientists of whole world, that resulted in creation of new approaches in projections and design of natural and anthropogenic disasters and promotion of renewal of network of scientific supervisions and scientific data collection.

By the decision of Presidium of the National academy of sciences (NAS) of Ukraine, Ministry of education and science of Ukraine and Geophysical center of the Russian academy of sciences (GC RAS) from April, 3, 2006 the Ukrainian branch of the World data center (UbWDC) for solar-terrestrial physics and physics of solid earth was created in NTUU “KPI” ESC “IASA”, that was affirmed by Agreement about partnership, collaboration and scientific exchange between ESC “IASA” of NAS of Ukraine and Ministry of education and sciences of Ukraine and GC RAS from May, 17, 2006.

Important factor influenced on creation of UbWDC exactly in ESC “IASA” was the interdisciplinary orientation of institute, presence of the own synthesized information (results of researches on sustainable development, which are conducted by the staff of this institute), and plenty of scientific relations between ESC “IASA” and other scientific institutions of Ukraine and world.

3 DEVELOPMENT OF UBWDC AND MODERN STATE

The important part of UbWDC development became the IT-orientation of NTUU “KPI”, which allowed providing all of the processes of data acquisition, storage and transfer in WDC on the base of modern IT-technologies and powerful computing facilities.

It is necessary to notice that NTUU “KPI” is the central node of “URAN” network (URAN - Ukrainian Research & Academic Network), that provided the substantial diminishing of expenses on data communication between scientific institutions which are added to the network. Further connecting of URAN to the European network GEANT2 in 2007, opened up a number of new possibilities in exchange of the information with scientific institutions of Europe and whole world.

But considerable volumes of information and modern models, which are used in researches of the global systems, stipulate the new high-quality level of the required computing power. For this purpose in ESC “IASA” together with UbWDC a High performance computing center (HPCC) was created, which provide work of cluster on the base of architecture of Intel Xeon and data storage, based on IPStore technology.

All above-mentioned resources became the links of general structure of UbWDC cooperation according to the resulted chart (Figure 1).

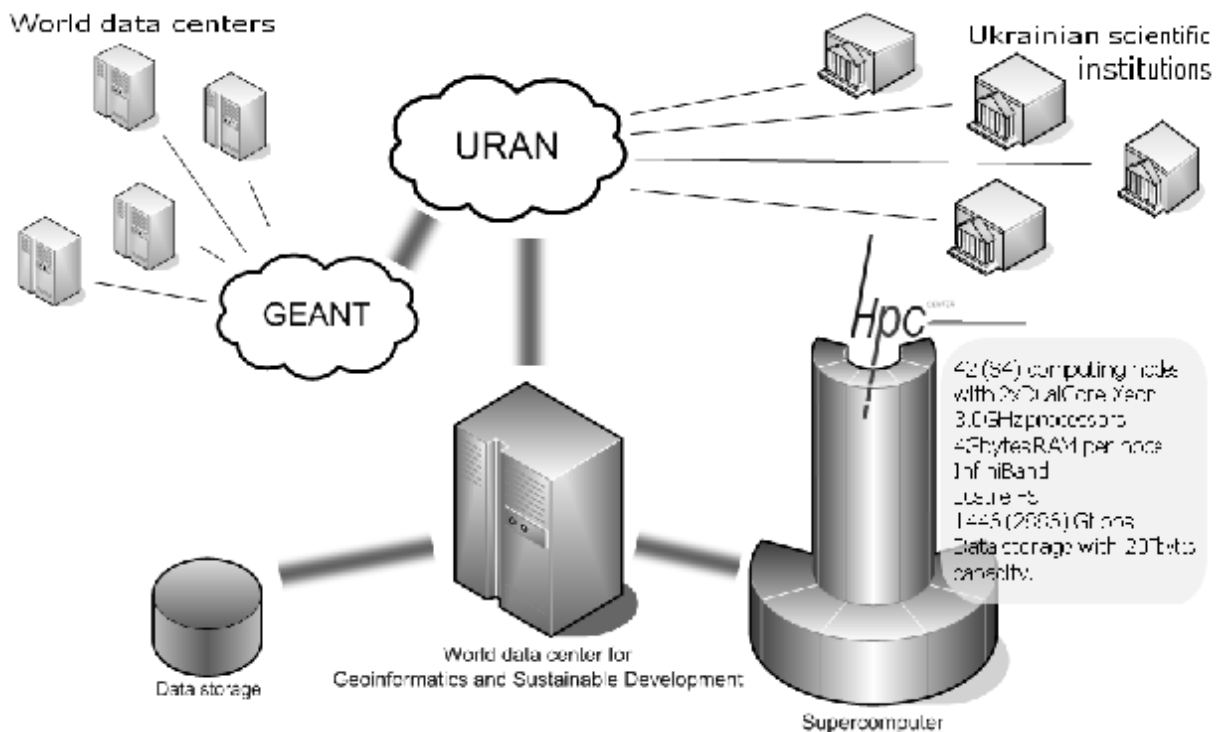


Figure 1. General structure of UbWDC cooperation

For UbWDC such general tasks were formed:

- 1) Organization of the effective system of data collection:
 1. Search for data sources.
 2. Establishment of contractual relationships with the national and world data providers.
 3. Development of subsystems of direct data collection.
- 2) Providing of comfortable access for users:
 1. Creation and support of web-portal with online access and data retrieval (www.wdc.org.ua).
 2. Providing of multidimensional interfaces for data access.
 3. Creation of databases.
 4. Planning and development of additional software for comfortable work with data.

In accordance with these tasks the works on establishment of relations with the data providers were started. For UbWDC such scientific directions were set as priorities:

1. Sustainable development
2. Geoinformatics:
 1. Physics of solid Earth;
 2. Solar-terrestrial physics;
 3. Oceanography;
 4. Astrophysics;

5. Cartography.

This report presents all final results of researches on sustainable development — science area which is provided directly by UbWDC.

For integration in the WDC system and providing of the second direction (geoinformatics) by authentic information, agreements were signed about partnership and scientific exchange with academic establishments of NAS of Ukraine and RAS. The complete list of organizations-partners and proper directions is resulted in Table 1.

Table 1. UbWDC partners and their scientific directions

№	Institution	Scientific area
1	The committee on Data for Science and Technology (CODATA)	General methodology of working with data
2	Institute of Physics of solid Earth of RAS	Physics of solid Earth
3	Geophysical Center of RAS	Physics of solid Earth, solar-terrestrial physics and geoinformatic systems
4	Institute of Geophysics of NAS of Ukraine	Seismology, gravimetry, thermal currents, archaeo- and paleomagnetism, magnetic measures, modern movements
5	National Center of Aerospace researches of the Earth of NAS of Ukraine	Aerospace pictures for application in geology, ecology, agriculture, forest and water economy, at prognostication of risks of natural and anthropogenic processes, prognostication of global changes of environment and catastrophic processes
6	Main astronomic observatory of NAS of Ukraine	Space geodesy and geodynamics; cosmic rays, solar data
7	Marine hydrophysical institute of NAS of Ukraine	Oceanology and hydrometeorological data
8	Institute of Geography of NAS of Ukraine	Cartography data

Together with these partners UbWDC began the row of general projects which already gave some results:

- 1 CODATA 2008 conference (<http://codata08.org.ua>);

with GC RAS such directions of researches were defined:

- 1 development of complex of databases and algorithms of treatment with the purpose of system prognostication of conduct of the difficult anthropogenic and natural systems (joint grant of RFBR RAS and NAS of Ukraine);
- 1 creation of the joint analytical system of primary collection, treatments and transfers of data to separate scientific directions;
- 1 participation in creation GRS «Russia»;
- 1 participation in the project of EGY (Electronic Geophysical Year).

with IGP:

- 1 the first stage of introduction of the automated system of geophysical data saving is conducted with the elements of publication of seismological data;
- 1 development of recommendations is conducted for modernizations of the systems of transmission and seismological data saving.

with NCASRE:

- 1 work on creation started to model for the solution of tasks of thematic tasks with their further realization on the base of calculable powers of UbWDC.

with IG:

- 1 development and support of electronic version of National Atlas of Ukraine (2008, the main developers are the Institute of Geography of NAS of Ukraine and LLC "Intellectual Systems - GEO") on the technical base of UbWDC
- 1 creation of the joint scientific-educational laboratory of dimensional (geographical) data bases and use of geoinformational systems.

UbWDC also executes the tasks of the Government having a special purpose program "Informations and communications technologies in education and science" on 2006-2010.

Works are constantly conducted on preparation and publication of information on the specialized web-portal of <http://wdc.org.ua> with the help of which users from all the countries in real time receive full and open access to data and information (free of charge, without restriction). All data and information given to UbWDC are accessible to all the users and other WDC. Portal has topical index of information and data, provide users with facilities for data retrieval and data loading. Portal topics are assigned corresponding organization-partners, they can place, correct

and remove the information and data independently in their topics and bear responsibility for their authenticity. Organization-partners can provide users with additional information and provide high-professional consultations if necessary.

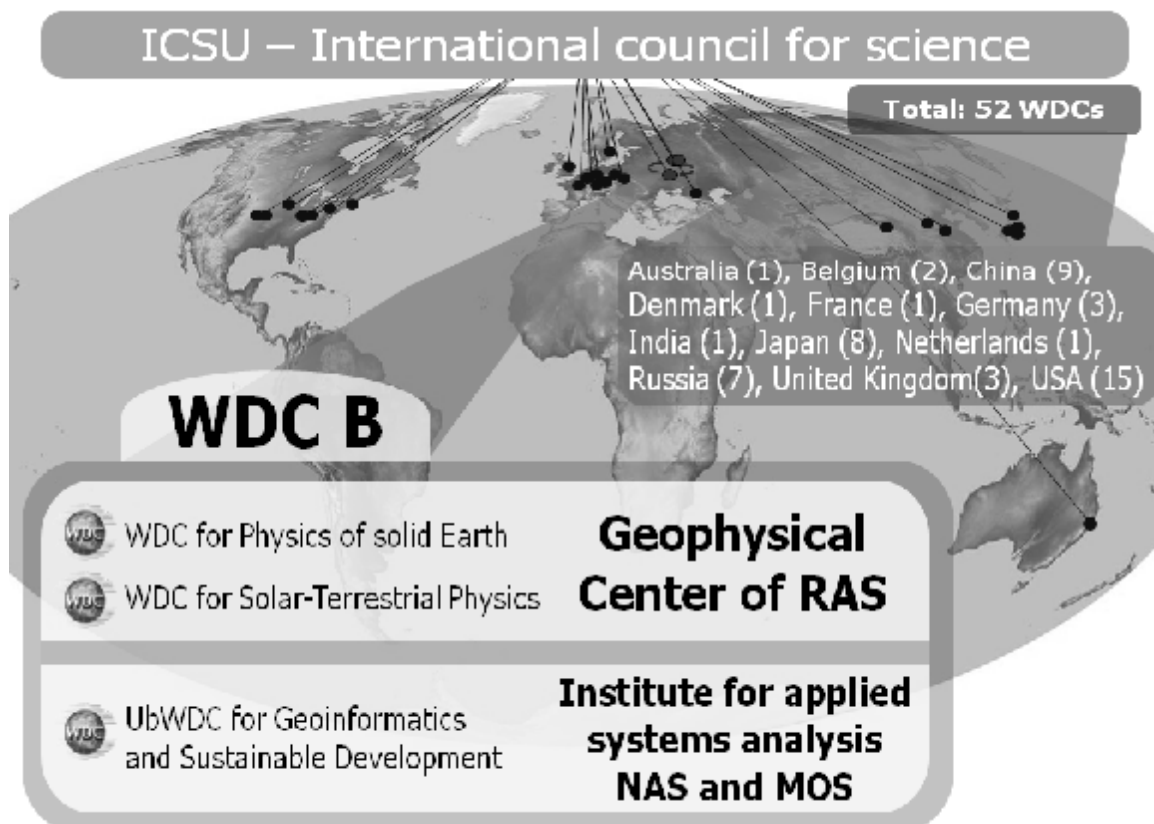
Necessary information and data users can receive in the UbWDC office directly.

For collaboration of wide circle of developers which work on different projects of WDC, an official knowledge and documenting base was created on the basis of Wiki-system with the use of opened MediaWiki software (which is used in the world known encyclopaedia of Wikipedia).

All program developments of UbWDC both independent and in cooperation with partners, are held in the scopes of united complex system of exchange, processing and storage of scientific information, that is the group of information resources, technologies, hardware and software and technical facilities of processing and connection, for providing direct data receiving, control of information transmission to the different categories of users according to authorities of access. Due to the module approach, use of developed facilities of data storage Oracle, powerful calculating resources of cluster and large capacity of URAN and GEANT networks system is able to provide the range of independent user-friendly interfaces and mechanisms for organization of data adding, processing and presentation, oriented on the needs of every partner, for instance the language of metadescription, that allows users to set their own models for global modeling of sustainable development processes in global and regional contexts, as well as visualization facilities, integrated with geoinformational systems for data representation. The developing system will have possibilities for data exchange with information system of different types of other science institutions and is aimed to integration with informational WDC resources.

4 CERTIFICATION

In 2008 UbWDC began preparation to the certification on the full-fledged member in world data center System (Figure 2).



Following the recommendations there was an International Russian-Ukrainian seminar “Forming of global geoinformatic space for the study of the issue of the urgent problem of Earth” on April, 23-25, 2008, where the topic of technical providing of UbWDC, prospective of its long-termed stability, correspondence to the principles and responsibilities of World Data Centers etc.

In seminar took part representatives of academic institutions of NAS of Ukraine and RAS, M. Z. Zgurovsky, academician of NAS of Ukraine, ICSU National Scientific Member from Ukraine, scientific supervisor of UbWDC; V. I. Starostenko, academician of NAS of Ukraine, director if Institute of Geophysics; O. E. Sovga, academic

secretary of Marine HydroPhysician Institute of NAS of Ukraine; V. I. Lyalko, academician-member of NAS of Ukraine, director of Science centre of Aerospace researches of the Earth; Ya.S. Yatskiy, academician of NAS of Ukraine, director of Main astronomic Observatory of NAS of Ukraine; O. O. Gliko, academician RAS, director of Insitute of Physics of the Earth; O. D. Gvishiany, corresponding member of RAS, director of Geophysical Centre of RAS etc.

Participants of the seminar decided that first stage of evaluation of UbWDC was successful, and it was recommended to pass the final stage of evaluation of certification of UbWDC during the CODATA-2008 conference on October, 5-8, 2008 as the Ukrainian world data center (UWDC) for geoinformatics and sustainable development during which Ukraine will get a chance reason to become the thirteenth state in the world, which is the member of WDC system.

5 CONCLUSIONS

The creation of WDC Ukraine will help not only improve situation with data accessibility for Ukrainian researchers but will greatly catalyze the process of Ukrainian science integration into the global one.

Main priorities for today are to continue the creation and implementation of additional user-friendly software tools, which would make possible to unify the receiving, storing, processing and transiting data. It is also very important to provide the abilities for future data mining and modeling with the usage of stored data.