

# ACTIVITIES AND PLAN OF THE CENTER FOR GEOPHYSICS (BEIJING) FROM WDC TO WDS

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## ABSTRACT

*In this report we introduce the development of the WDC for Geophysics, Beijing included our activities in the electronic Geophysical Year (eGY) and in the transition period from WDC to WDS. We also present our future plans. We have engaged in the development of geophysical informatics and related data science. We began the data visualization of geomagnetic fields in the GIS system. Our database has been expanded from geomagnetic data to the data of solid geophysics, including geothermal data, gravity data, and the records of aurora sightings in ancient China. We also joined the study of the history of the development of geophysics in China organized by the Chinese Geophysical Society (CGS).*

**Keywords:** WDC, WDS, Geophysical Informatics, eGY

## 1 INTRODUCTION

The establishment of the World Data Center system was one of the achievements of the International Geophysical Year (IGY, 1957-1958). China was one of the first participants in the IGY. A committee for IGY was founded by the Chinese Academy of Sciences (CAS). Academician Kezhen Zhu was the chair of the committee. The IGY committee promoted the establishment and development of the branches of geophysics in China. The Shenshan Geomagnetic Observatory was awarded a gold medal by the International Association of Geomagnetism and Aeronomy. Since IGY, Chinese geophysicists and other scientists working in adjunct areas have made great achievements.

In the late 1980s, Chinese Earth science scholars proposed to establish WDCs in China. This proposal was supported by Academicians Duzheng Ye and Honglie Sun, the vice presidents of the Chinese Academy of Sciences. With their efforts, the Chinese WDC Coordination Committee and nine data centers in the WDC system were founded in 1988. The chair of the committee was Academician Honglie Sun, and the secretary of the committee was Academician Jiulin Sun.

The WDC for Geophysics, Beijing (original name: the WDC-D for Geophysics) is one of the first centers of the WDC system in China. The WDC is located in the Institute of Geophysics, CAS. It has received a good deal of help from the Institute of Geodesy and Geophysics in Wuhan, CAS. In 1999, the Institute of Geophysics, CAS and the Institute of Geology, CAS were combined into the Institute of Geology and Geophysics, CAS. The Laboratory of Space Physics (ionosphere and upper atmosphere physics) moved into this institute at the same time. The WDC for Geophysics, Beijing has received more and more support for core data resources in geophysical research fields ranging from solid geophysics to geospace physics.

## 2 WORKS OF THE WDC FOR GEOPHYSICS, BEIJING, BEFORE eGY

The precious magnetograms measured in the Shanghai Shenshan Observatory, which was founded in the 1870s, played an important role in the foundation of the WDC. The Shenshan Observatory, which was named initially

the Xujiahui Observatory, has existed for more than one hundred years. It is one of the world's oldest geomagnetic observatories.

Beginning with the data from the Sheshan Observatory, the WDC for Geophysics, Beijing started the geophysics data work in China. The center has done data work both on traditional media (such as photo paper and film) and electronic media. The center has built a group of databases, beginning with a geomagnetic field database and then databases covering most branches of geophysics. Many geophysical observation results were digitalized and shared online in this data center.

The first WDC project was the recovery of the magnetograms that had been obtained at the Sheshan Observatory over a period of 136 years and were damaged due to aging. These magnetograms were of significant importance for geomagnetic field studies. The broken magnetograms were recovered by specialists. Magnetic plots that were recorded on 36mm photographic microfilms were copied onto microfilms. Our center also started to study the construction of the China Geophysics Database (Gao et al., 1992).

During the mid 1990s, the WDC attempted to forecast the peak of each solar activity by making use of sunspot data from the Sheshan Observatory as well as world-wide geomagnetic data. The result of this research project was presented at the International Conference of Solar-Terrestrial Prediction in 1996 (Peng, Chang, Tschu, & Wang, 1997).

In the late 1990s, there was an increasing demand for online scientific data services. According to the task of the pilot project of the Ministry of Science and Technology, the WDC began to utilize a computer network to provide data service. Senior engineer Hongfei Chen helped the center set up the network server, and the WDC's website was posted online. The geomagnetic data were first uploaded onto the server. Then the data measured at the Zhongshan Observatory, Antarctica and at the newly-founded geomagnetic observatory of CAS were added to the database.

The online database was initially built in 2000, using the ASP language and SyBase environment. In 2003, the online database of geomagnetic-field 1-minute mean values was accomplished by using JSP and the SQL server. In the new system, a lot of hard drive space was saved and the search speed of the database was increased significantly. The data sets of daily measurement were automatically uploaded to the online database, and the site could generate the magnetograms of arbitrary time-intervals dynamically according to users' needs (Peng, Wang, Zheng, Xing, et. al., 2007)

Along with geomagnetic field data, the WDC for Geophysics, Beijing also started to collect the data of other branches of geophysics. With the critical support of Xiangru Kong, the former deputy director of the Institute of Geophysics, CAS, the data sets of magnetotelluric soundings in Inner-Mongolia and Tsinghai-Tibet were added to the website.

In 2005, Academician Jiyang Wang and Prof. Shengbiao Hu provided their data collection of the geothermic measurements in the mainland of China during the last 50 years. The WDC also collected the records of gravity anomalies in different areas of China, which were measured by R. P. Lejay, Gongshu Gu, Rongsheng Zeng, and Zhongyin Zhang in the 1940s. This set of data, which was measured during the war years, is of great significance. In 2006, solid geophysics data from Taiwan, oceanic geothermic data, and deep seismic soundings data in North China were added to the online database.

### **3 ACTIVITIES FROM THE eGY TO THE WDC-WDS TRANSECTION PERIOD**

During 2006-2008, the WDC for Geophysics, Beijing put significant effort into the promotion of eGY activities in China. According to the instruction of Huadong Guo, the deputy general secretary of CAS, Fenglin Peng suggested to the secretary general of the Chinese Geophysical Society, Rixiang Zhu, that China join the eGY. With the support of the presidents of CGS and directors of the institutes for geophysics and space science in China, The Chinese government decided to found a national committee for eGY in China. The Chinese Geophysical Society, the Chinese Society of Space Research, the Seismological Society of China, the Chinese Meteorological Society, and the Chinese Society of Oceanography joined in founding the committee. Liu Guangding, honorary president of CGS, was appointed as honorary president of the eGY national committee of China; Shui Wang, president of CGS, was appointed as president of the eGY national committee of China. Fenglin Peng, the director of WDC for Geophysics, Beijing, was appointed as deputy secretary general of this committee.

The WDC for Geophysics, Beijing promoted data sharing among academic organizations. A national data-sharing platform of geosciences was formed. This is the basis of further cooperation among the academic organizations. The development of the WDC for Geophysics also benefited from the point of view of data sharing.

In May 2007, the conference of the centers in the World Data Center organization was held in Bremen, Germany. Nineteen representatives from 9 data centers in China attended the meeting. In this conference, it was agreed that the interoperability of data should be developed among the World Data Centers. A beta portal was first set up among 10 centers in the WDC system, including the WDC for Geophysics, Beijing.

Since 2007, a virtual geophysics platform has been constructed. The virtual platform for Geophysics (<http://www.geophys.cn>) and the concerted work environment platform for a virtual organization on geophysics (<http://e.geophys.cn>) (<http://vp.geophys.cn>) were included in the platform (Peng, Wu, Guo, Zhang, Chen, Zhu, et al., 2008).

In May 2008, in collaboration with the UNESCO SOC Global Alliance for ICT and Development, we held a session on the sharing of scientific data and knowledge with the seventh Asia-Pacific City Informatization Forum at Shanghai, held in the same year. In October, we held a special session at the annual conference of CGS: Session 1 - eGY and the advance of geophysical informatics.

In 2008-2009, we started the data visualization analysis of the geomagnetic field in the GIS system. Cooperating with the Graduate University of CAS and Peking University, WDC for Geophysics, Beijing visualized the data from IGRF 10 (The 10th generation of International Geomagnetic Reference Field) in the Google Earth system. We used a new toolbox from Matlab-Google Earth Toolbox, which provided various plotting/drawing functions that can be saved as KML output and loaded into Google Earth. With the functions in this toolbox, we can display spatially and temporally distributed data within Google Earth (Wang, Shen, Peng, Yuan, Tang, Xing, et al., 2008; Wang, Peng, Ma, Yuan, Bai, & Sun, 2009).

In 2010, the information committee of CGS and the Computer Network & Information Center, CAS organized an e-science salon on Earth-planet-space physics and engineering. Many senior scientists in geophysics, geology, astrophysics, space physics, and information science/technology eagerly joined the activity. This salon will be held again in the future. It will take the active role required to push the development of data-sharing, data science, and informatics in the area of geophysics.

During 2010-2011, the WDC for Geophysics, Beijing studied the data and events recorded in ancient Chinese documents. The Institute of Science History organized the ancient records of aurora-sightings in China. These records and the data of geomagnetic field variations during the eclipses in 1930s were uploaded to the server and shared online.

#### 4 ON-GOING WORK AND PLAN OF OUR CENTER

As a partner in the data-sharing infrastructure of Earth system science built by the Ministry of Sciences and Technology of P. R. China, the Center for Geophysics will receive more financial support every year after 2011. Our center plans to organize all data resources, including those of geomagnetics, geothermic, gravity, Earth electricity, and Earth deep structure. Nine main theme databases on geomagnetics, geothermics, gravity, geophysics in Taiwan, earth deep structure, planetary geophysics, and urban environment geophysics will be constructed in the next few years. The most important of these databases are listed below:

- (1) Basic parameters of geophysics;
- (2) Geomagnetic data, including: data from geomagnetic observatories, data from the field of geomagnetic survey in China, paleomagnetism data;
- (3) Gravity data in China since the 1900s;
- (4) Geothermics;
- (5) Geodynamics;
- (6) The structure of deep Earth, including magnetotelluric sounding and deep seismic sounding data;
- (7) Earth electromagnetism;
- (8) Space physics, including: the Database of Ionosphere and Upper-Atmosphere Physics, which is observational data from the ionosphere and upper-atmosphere physics, data from the national ionosphere GPS observation net, the largest data set of ionosphere GPS observations in China;
- (9) Historical and scholars' information about Chinese geophysics.

