

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

Fenglin PENG^{1,2}, Maining MA³, Le PENG^{2,5}, Jian ZHANG³, Gengxiong CHEN^{1,2}, Yufang LI⁴, Bo SUN¹, and Yunfei ZHANG²*

¹*Institute of Geology and Geophysics, Chinese Academy of Sciences, P. O. Box 9825, Beijing, 100029, P. R. China, Email: pengfy@yahoo. cn*

²*Center for Geophysics, World Data System, P. O. Box 9825, 100029, Beijing, P. R. China*

³*Earth Science College, Graduate University of Chinese Academy of Sciences, 100039, Beijing, P. R. China*

⁴*Department of Electricity & Information, Normal College, Beijing Union University, Beijing, 100011, P. R. China*

⁵*Department of Physics, City University of New York, New York, USA*

ABSTRACT

In this report we introduce the development of WDC for Geophysics, Beijing including our activities in the eGY and in the transition period from WDC to WDS. We also present our future plan. We engaged in the development of geophysical informatics and related data science. We started the data visualization of geomagnetic field in the GIS system. Our database has been expanded from the geomagnetic data to the data of solid geophysics including geothermal data, gravity data, and the records of aurora sightings in the ancient China. We also joined the study on 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 International Geophysical Year (IGY, 1957-1958). China is one of the first participants of the IGY. A committee for IGY was founded by Chinese Academy of Sciences (CAS). Academician Kezhen Zhu was the chair of the committee. The committee of IGY promoted the establishment and development of the branches of the geophysics in China. The Shenshan Geomagnetic Observatory was awarded a gold medal by International Association of Geomagnetism and Aeronomy. Since IGY, Chinese geophysicists and other scientists working in the adjunct areas have made great achievements.

In late 1980s, the Chinese scholars on Earth science proposed to establish data centers as WDC in China. This proposal was supported by Academician Duzheng Ye and Honglie Sun, the vice presidents of Chinese Academy of Sciences. With their effort, 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 got a lot of help from the institute of Geodesy and Geophysics in Wuhan, CAS. In 1999, the Institute of Geophysics, CAS, and Institute of Geology, CAS, combined as the Institute of Geology and Geophysics, CAS. The Laboratory of Space Physics (ionosphere and upper atmosphere physics) also move into this institute then. The WDC for Geophysics, Beijing, has got more and more support of core data resources in geophysical research fields ranging from solid geophysics to geospace physics.

2. WORKS OF WDC FOR GEOPHYSICS, BEIJING, BEFORE eGY

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

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

Beginning with the data from the Sheshan Observatory, WDC for Geophysics, Beijing started the data work of geophysics in China. The center have done data work both on traditional media (such as photopapers and films) and electronic media. The center has built a group of databases: Beginning with the database of geomagnetic field and then covered most branches of geophysics. A lot of results of geophysical observations was digitalized and shared online in the data in this data center.

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

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

In late 1990s, there was an increasing demand of the scientific data service online. 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 to set up the network server, and the website of the WDC was posted online. The geomagnetic data was first uploaded on 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 with ASP language and SyBase environment in 2000. In 2003, the online database of geomagnetic-field 1-minute mean values was accomplished by using JSP and 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 uploaded to the online database automatically, and the site could generate the magnetograms of arbitrary time-interval dynamically according to users need (Peng, Wang, Zheng, Xing *et.al.* 2007)

Besides the data of geomagnetic field, the WDC for Geophysics, Beijing, also started to collect the data of other branches in geophysics. With the critical support of Xiangru Kong, the former deputy director of the Institute of Geophysics, CAS, the data sets of magnetotelluric sounding 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 anomaly in different areas of China, which were measured by R. P. Lejay, Gongshu Gu, Rongsheng Zeng, and Zhongyin Zhang in 1940s. This set of data, which was measured during the war years, is of great significance. In 2006, the data of solid geophysics in Taiwan, the data of oceanic geothermic and the data of deep seismic sounding in North China were added to the online database.

3. ACTIVITIES FROM eGY TO WDC-WDS TRANSECTION PERIOD

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

The WDC for Geophysics, Beijing, promoted the data sharing between the academic organizations. A national

data-sharing platform of geosciences was formed. This is the base of the further cooperation between the academic organizations. And the development of the WDC for Geophysics also benefited from the point of view of data sharing.

In 2007 May, the conference of the centers in the World Data Center organization was held in Bremen, Germany. 19 representatives from 9 data centers in China attended the meeting. In this conference, the organization reached the agreement that the interoperation of the data should be developed among World Data Centers. A beta portal was first set up between 10 centers in the WDC system including WDC for Geophysics, Beijing.

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

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

In 2008-2009, we started the data visualization analyzing on geomagnetic field in GIS system. Cooperating with the Graduate University of CAS and Peking University, WDC for Geophysics, Beijing, made the data of IGRF 10 (The 10th generation of International Geomagnetic Reference Field) visualized in the Google Earth system. We use a new toolbox in Matlab-Google Earth Toolbox, which provides various plotting/drawing functions that can be saved as KML output, and loaded in 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, and 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 on geophysics, geology, astrophysics, space physics and information science/technology joined the activity eagerly. The holding of this salon will be kept on in the future. It will take an active role required to push the development of the data-sharing, data science and informatics of geophysics.

During 2010-2011, 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 the 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 of Data-sharing Infrastructure of Earth System Science built by the Ministry of Sciences and Technology of P. R. China, the Center for Geophysics can get more financial support every year from 2011. Our center plans to organize all resources of data including the data of geomagnetics, geothermic, gravity, Earth electricity, and Earth deep structure. 9 main theme databases on geomagnetics, geothermics, gravity, geophysics in Taiwan, earth deep structure, planetary geophysics and urban environment geophysics will be constructed in the near years. The most critical ones of them are listed below:

- (1) Basic parameters of geophysics;
- (2) Geomagnetic data, including:
 - the data of geomagnetic observatories,
 - the field of geomagnetic survey in China,
 - paleomagnetism data
- (3) Gravity data in China since 1900s.
- (4) Geothermics;
- (5) Geodynamics;
- (6) Structure of deep Earth, including data of magnetotelluric sounding and deep seismic sounding;
- (7) Earth electromagnetism
- (8) Space physics

Database of Ionosphere and upper-atmosphere physics: Observation data of Ionosphere and upper-atmosphere Physics, Data of national Ionosphere GPS observation net, which is the biggest data set of ionosphere GPS

observation in China
(9) Historical and scholars' information of Chinese geophysics

We plan to organize a series of salons and conferences to promote the development of data science and geophysical informatics.

5. SUMMARY

In the more than 20 years, starting with the magnetograms of Sheshan Observatory, WDC for Geophysics, Beijing have collected the data from various branches of geophysics such as geomagnetic field, gravity and geothermics. The WDC for Geophysics, Beijing, also put a lot of effort into the digitalization and data visualization of the results of all kinds of observations on geophysics. With the contribution of the scholars and researchers from the universities and research organizations in China, WDC for Geophysics, Beijing, have built a group of high-quality databases. The online databases were maintained and updated by making use of the information technology developed during last twenty years. And an online platform was founded for data-sharing between the research organizations for geophysics in China.

In the past 6 years, WDC for geophysics, Beijing also promoted the activities of eGY as an important role for the eGY in China. Several conferences and academic activities about eGY and the development of geophysical informatics, e-science for geophysics and data science in geophysics have been hold.

Center for Geophysics and the National Laboratories collaborates on Data-Sharing Infrastructure of Earth System Science. These works are the base of the further development of geophysical informatics.

6. ACKNOWLEDGEMENTS

Thanks for the financial support from the Ministry of Sciences and Technology of P. R. China by through the Data-sharing Infrastructure of Earth System Science and Chinese Academy of Sciences by the key project of knowledge creation to WDC system.

7. REFERENCES

- Gao, M. Q., Lu, W., Wen, X. and Gao, M.,(1992) China Geophysics Database in WDC-D for Geophysics, *CODATA Bulletin*, 24(6), 2.
- Peng, F., Chang, H., Tschu, K. K. & Wang, J. L., (1997) The Use of Geomagnetic AQD near Sq Focus for Predicting the Magnitude of Sunspot Maximum, *Solar-Terr. Predict.*, 5, pp 99-102.
- Peng, F., Wang, D., Zheng, X., Xing L., Tang, K., Yue, B, Shen, X., Zhang, J., Peng, L. & Huang, Q. (2007) The Internet Databases of the World Data Center for Geophysics, Beijing. *Data Science J.* 6(S), 879-882.
- Peng, F., Shen, X., Tang, K., Zhang, J., Huang, Q., Yue, B., & Wang, D. (2007) Data-sharing Work of the World Data Center for Geophysics, Beijing, *Data Science J.* 6(S), 404-407.
- Peng, F., Wu, Z., Guo, J., Zhang, J. Chen, X., Zhu, R., Wang, S. & Liu, G. (2008) eGY in China: From IT to geophysical informatics and its outreach. *21st International CODATA Conference* (pp139), Kyiv, Ukraine
- Wang, D., Shen, X., Peng, F., Yuan, X., Tang, K., Xing, L. & Peng, L. (2008) Basic Research of IGRF 10 Model on Web Visualization. *21st International CODATA Conference* (pp51), Kyiv, Ukraine
- Wang, D., Peng, F., Ma, M., Yuan, X., Bai, C., & Sun, L.(2009) Visualization Research of IGRF Model. *Seismological and Geomagnetic Observation and Research* 30(4), 7-11.
- Yang, L., Peng, L., & Peng, F. (2008). The Weather, Geologic and Geophysical Environment as a Factor in Transportation Information System. *21st International CODATA Conference* (pp157), Kyiv, Ukraine