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Preliminary study of Chinese Antarctic data management in accordance with the international framework

Cheng Shaohua (程少华), Zhu Jiangang (朱建钢), Ling Xiaoliang (凌晓良), Fang Binxian (方斌贤) and Jiang Congtao (蒋从涛)

Polar Research Institute of China, Shanghai 200129, China

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Abstract Antarctic data management is the research focus, which the international Antarctic organizations, e.g. Antarctic Treaty Consultative Meeting (ATCM), Scientific Committee on Antarctic Research (SCAR), and Council of Managers of National Antarctic Programmes (COMNAP) have been paying close attention to and promoting actively. Through the co-effort of international Antarctic organizations and member countries concerned in recent years, Antarctic Data Directory Syatem (ADDS) is established as the most important basic programme for development of the international Antarctic data management system. At present, Joint Committee on Antarctic Data Management (JCADM) is responsible for organizing and coordinating the international Antarctic data management, and implementing the project ADDS. In this paper the background on Antarctic data management in time-sequence and the structure of international framework are introduced, meanwhile, it is necessary to develop ADDS first of all. The ADDS mainly consists of the two principal parts: National Antarctic Data Center (NADCs) of all the party members and Antarctic Main Directory (AMD), the best available technology for creating ADDS is to make full use of International Directory Network (IDN) and adopt its Directory Interchange Formats (DIF). In the light of the above requirements, combined with Chinese-specific situation, the contents, technical and administrative methods on Chinese Antarctic data management are discussed to promote our related work.

Key words international framework, Antarctic data management, Antarctic Data Directory Syatem, Antarctic Main Directory.

1 Introduction

Antarctic science is a multi-discipline subject, in which many scientists of some countries participated. Antarctic research is a special item, which needs the international cooperation of scientists of the world. Modern information technology should be used to study the global programs (Cheng 1992), the acquired Antarctic data on which tremendous exertion was spent will be well shared and managed in international method and standard. Under this special background, the Antarctic data management is of momentous significance.

Article Ⅲ (1)(C) of the Antarctic Treaty calls on parties to exchange and make freely available scientific observations and results from Antarctica, so that the re-

sults can be shared by some researcher in the world. A number of ATCM recommendations have resulted from this political context and these have provided the driving force for current initiatives on data management. The scientific context arises from the increasingly large and complex issues being addressed, including environmental monitoring under the Madrid Protocol on Environmental Protection to the Antarctic Treaty and Global Change Programs such as the International Geosphere Biosphere Program(IGBP). The economic context arises from the available data collection for improving return on investment(data utility) by increasing awareness of data existence. Antarctic data management is of wide significance and current demand based on above three points:

·Data management has been turned to a necessary and important part of the international polar scientific research;

·Parties can benefit from exchanging and making freely available scientific observations and results from Antarctica;

·Antarctic study needs close cooperation between party members, and between party members and other data users;

·To bring about integrating the data of different disciplines, different regions;

·Acquired Antarctic data and research results by each country are resources of human race and need international coordination to manage them;

·Through investigating all acquired scientific data, the way of exchanging data will be widen , so that avoiding duplication of effort in data collection, analysis and process;

·Creating standard data set is conducive to optimizing research objective, improving data quality, and acquiring research result quickly;

·Logistic management is prompted to scientific management and the utilize of persons, resources, products are improved.

2 Background

Timely and better data management can improve both the quality and economics of Antarctic scientific research(Cheng 1993). SCAR and other international agencies have done some different preliminary work in their own fields. The World Data Center(WDC) under International Council of Scientific Union (ICSU) plays an important role in improving international data exchange. Moreover, with the support of Committee on Earth Observation Satellites(CEOS), the space agencies of USA, Japan and European countries standardize the access to Antarctic Data Directories of IDN.

Some SCAR member countries, such as USA, UK, Italy, New Zealand, French, Germany and Australia have established Antarctic data management organizations with well-equipment. New Zealand, USA, French and Italy made a joint effort to found International Centre for Antarctic Information and Research(ICAIR) at Christchurch, and created an information system with respect to Ross Sea region, which is based on Geographical Information System(GIS). The Antarctic administration of UK, Italy and Australia have set up their own National Antarctic Data Center, and have done a lot of things with IDN. In the United States, National Snow & Ice Data Center and WDC-A are the center for such researching. In China, Polar

Research Institute of China(PRIC) raised the project of Chinese Antarctic Information System(CAIS) as one item of National Antarctic Research Program early in 1990. We have been making efforts both on theories and practice.

There are two respects to be concerned. Firstly, although Antarctic data management is considered preferably(some countries have spent lots of money on it), the Antarctic data management haven't been integrated in the world. Secondly, the Antarctic member countries administrate the Antarctic activities and manage the Antarctic data in different way, such as British completely-centralized management, American completely-decentralized management and some others between them, so they make progress differently.

To sum up, in some countries and some disciplines, the Antarctic data management has been improved, but the data's accessibility and comparability haven't been resolved radically. The essence of data management is integrated directory, data standardization and international Antarctic data management system. In fact, there are no international agencies to coordinate and organize data management. In general, it becomes worse.

New scientific thoughts boom and all kinds of advanced technologies are put into practical use. It is clear that we do need an international standardized management to deal with the increasing Antarctic data and more comprehensive and complicated scientific problems(such as global change and environmental monitoring). The primary data management (little-scale and dispersed) doesn't meet the multi-national and multidisciplinary and standardized data-sharing. The unity of programming, disposing and action is inevitable.

The issue of data management was first raised within the Antarctic Treaty System with ATCM Recommendation XIII-5(1985), which called on SCAR for advice on steps that could be taken to improve the comparability and accessibility of Antarctic scientific data, in the context of additional protective measurements for the Antarctic environment. In response to this, SCAR carried out an initial review of databases in the biological sciences and then in 1989 established the SCAR ah hoc Committee on the Coordination of Antarctic Data(CCAD). Subsequent to this, ATCM Recommendation XV-16(1989) made a number of recommendations to governments to assist the work of the CCAD. ATCM, SCAR and COMNAP has been taking a close look at it. Especially the requirements of environmental monitoring defined by the Madrid Protocol on Environmental Protection to the Antarctic Treaty, and research into global change under the IGBP. Global Change and the Antarctic(GLOCHANT) adopted by SCAR Executive Committee in April 1993, make Antarctic data management important, and it becomes new spotlight.

Following adoption of the environmental protocol, the initial meeting of the Group of Experts on the Antarctic Environment(June, 1992) identified a number of requirements for a coordinated Antarctic data system to support the needs of environmental assessment and monitoring. The Planning Group also highlighted that establishment of an environmental monitoring data system would facilitate the creation of a border system for all scientific data collected in Antarctica.

The SCAR-COMNAP ad hoc Planning Group on Antarctic Data Management was established at XXII SCAR in June 1992 to replace the CCAD. The responsibilities

for the Planning Group include the development of a plan for the coordination and management of Antarctic data, taking into account SCAR's programs and requirements under the Antarctic Treaty System especially with respect to the Protocol on Environmental Protection to the Antarctic Treaty.

The Planning Group's research work is ratified and supported by ATCM, COMNAP, SCAR. XXIII SCAR in Rome(September, 1994) adopted the proposals of the Planning Group. XXIV SCAR in Cambridge(August, 1996) highlighted Antarctic data communication, exchange and management as SCAR's strategies. This meeting ratified 21 important suggestions, three of which is about Antarctic data management, they are XXIV R-19 the priority of the Antarctic data management, XXIV R-20 foundation of National Antarctic Data Center, XXIV R-21 foundation of SCAR-COMNAP JCADM to replace the CCAD.

In the First meeting of National Antarctic Data Center Managers with the First Proceeding of JCADM held in May 1997 at Christchurch, JCADM was founded to replace the Planning Group, which consists of members of SCAR,COMNAP, ICAIR, thirteen member countries, and NADC manager. Since then, the research of international Antarctic data management was put into effect from planning.

3 Infrastructure of the international framework

Before analyzing international framework of data management, the objective of ensuring accessibility of Antarctic data in multi-nation, multi-discipline and multi-type should be recognized. Thus, the requirement of scientific research and administration management must be analyzed.

The requirements in scientific research is as follows:

· The location of data storage, the method of data storage and data owner are inquired;

· The data accessibility is specified (data related information such as equipment of data collection or analysis method);

· The data is searched and accessed in several methods by advanced technique;

· The standard of data transmission is definited strictly;

· To establish the list of standard terms (thesaurus);

· Data directory and database can be accessed online;

· DIF authoring tool is provided involving the procedure and rule of examining data directory.

The requirement of administration management:

· Data management is highly laid stress on by the decision-making department, national SCAR and national COMNAP;

· Supported and actively coordinated by each discipline and researcher;

· Operation training for some users.

The above requirements formed the basic framework of Antarctic data management and the base of implementing ADDS. The first stage of international Antarctic

data management is to establish and develop ADDS with the help of IDN, as IDN not only has provided available directory structure, but also has included some description of Antarctic data. Its DIF can be extended conveniently into Antarctic data interchange format(ADIF) and be provided for research. We have to emphasize that ADDS only contain a general data description of scientific data(metadata), not a actual data set. The actual data hasn't be included in the central database of international Antarctic data management system.

The basic form of international framework include:

· SCAR parties must establish its NADCs and designate its manager;

· To develop DIF authoring tool for the parties to establish its national Antarctic data directory;

· Establish the AMD system which include parties ADIF.

In this international framework, AMD will be an important part of IDN system. Its function is for international scientific area to share data resource. The NADCs can be a site of AMD over Internet or can supply data on some media such as disc, tape, etc. for information service. As a set of national sharing data, AMD can be supplied for national scientific research and decision support. Beside this, it can also be used for large scale research such as IGBP, GLOCHANT and environment surveying.

4 Analyzing the current status of Chinese Antarctic data management

Since 1984, China has successfully accomplished Antarctic scientific expeditions 13 times, during which many projects involving multidiscipline were carried out and lots of observation data, field data were collected. With great efforts we gained some remarkable and valuable achievements, several of them is superior to the similar research projects of other countries, as is focused the attention upon by Antarctic sphere. However, this work started so late, and the fund available is so limited. All these factors above affect greatly the Antarctic scientific research. As concerns the data management and data sharing, a series of problems still unresolved is as follows:

(1) Most of Antarctic data collected for 13 years are stored respectively in researcher, institution, and work group, some of them not readily available, so it is very necessary to gather and archive these data-sets, and examining these data systematically by means of data description(e.g. data directory)is under circumstances;

(2) Full use of advanced information technology such as Internet cannot be made to understand timely International trends and acquire information on Antarctica with default of advanced service and technology. Meanwhile, the speed, accuracy, integrity in the course of data processing and data exchange is limited;

(3) Up to now, the general DIF is not still adopted to author data directory while the discipline database have been set up. Meanwhile, we have some difficulty in sharing and exchanging data on International data network, it makes the news on our research activities and achievements not readily available at home and abroad. Therefore, we should improve the extent, intensity of popularizing use of DIF and

encourage for users to utilize ADIF;

(4) Great importance is not attached to Antarctic data management, to a certain extent, by some departments or institutions.

Nevertheless, considerable attentions is now paid to Antarctic data management by the policy-making body and administrative institution, some work mentioned below is in progress.

(1) Paying close attention to the recent progress of International Antarctic data management, including translating into Chinese and collating the 1st, 2nd, 3rd and 4th reports of the Planning Group, and related resolutions, revising timely our plan and sending these information to all related staffs.

(2) Inviting director of ICAIR, Mr. Smith to China to direct our work, it advances greatly the activity and progress in Chinese Antarctic data management.

(3) According to requirements proposed by SCAR and COMNAP, CN-NADC was defined formally by Chinese Polar Administration(CPA), and its manager and the coordinator responsible for data directory were designated in 1995. Following this, we attended the first workshop of managers of NADCs. During this meeting, we were active in exchanging with other NADCs' managers and experts, broader contacts and liaisons have been made. On the basis of the general arrangement, combined with Chinese-specific situation, the operative and aimed proposals on Antarctic data management is addressed to the CPA.

(4) Along with establishment and intensive research of ADDS, Antarctic data management is defined as one of the foci, and planned, coordinated systematically as the indispensable part of ADDS. Now PRIC's Computer Network System (PRIC-CNS), set up and connected into Internet, provides the base for CAIS's further development and the powerful networking tool for data management and service.

5 Exploration of implementing of Chinese Antarctic data management

No doubt, Chinese Antarctic data directory, as advanced and practical searching tool, provide convenience for Antarctic research staffs and administrative officers, however, to collect, examine and address timely AMD involving all sorts of subject, is a complex and high-level task, demands several full-time staffs to undertake this job, plenty of expense and appropriate administration measures. Namely, it is also important that the national decision-making institution values this work highly and the executive institution supports greatly and provides plenty of funds. In fact, these expense and efforts will be repaid by the benefits to Antarctic science. Among these are:

on a national scale

- support for national Antarctic operators;
- best care for national programmes;
- improve efficiency of data management, utilization of data;
- facilitate interdisciplinary research.

on an international scale

· helpful to Antarctic science strategy and planning by avoiding unnecessary repetition in research and data collection;

· facilitate cooperation among nations;

· allow inter-operability with other international programmes (e. g. GLOCHANT);

· facilitate new research, through awareness of existing data and research.

Based on the views mentioned above, a series of measures to deal with Chinese Antarctic data management is addressed in accordance with the international framework, combined with Chinese-specific status:

(1) CN-NADC is responsible of organizing and coordinating this activity with reference to external experience. The first step is to investigate the Antarctic data collected over ten years by Chinese scientists and technicians, then to classify, collate, sum up and archive them. The regulation of Antarctic data management is required to establish. This helps to create a favorable atmosphere.

(2) To define this work as one of the key projects of the ninth five-year plan of national Antarctic research. To consider that Chinese Polar Information Network is connected to Internet as group-node of AMD, homepages of CN-NADC and CN-ADDS on Internet is build up for scientists to browse and search.

(3) To collect and author Chinese Antarctic data directory as quickly as possible based on DIFs, then to address them to the AMD host, ICAIR after being examined and verified by CN-NADC. Following this, to create CN-ADDS in accordance with international framework, and general library of Chinese polar data-set.

(4) CN-NADC not only collect and provide timely information on the recent development of international research programme on a large scale and discipline research, but also report the Chinese Antarctic data management and its development.

6 Discussion

(1) Establishing a comprehensive Antarctic data directory system is not of merely technical research, and requires that each of Party members actively participates in it and takes the obligation and responsibility of his own, especially a large quantity of expense and lots of efforts. Without these supports and aids of fund, it results in repeatition of expense and effort, loss of possibility of cooperation and collaboration, low rate of profits.

(2) Thorough-going realization of and agreement with this work is the essential prerequisite. The scientific significance and economic value of ADDS are evaluated and realized fully on the larger scale and in new perspective. The decision-making and administrative institutions should attach importance to fulfill the work of data management and scientific institutions, universities also give energetic support to it.

(3) Scientists and staffs engaged in polar research, especially directors of project or discipline, should to participate in the activities of authoring ADD and establishing ADDS. In fact, they can not only benefit from ADDS, but also make their scientific research and academic achievements known as quickly as possible by selection to

AMD, facilitate cooperation and coordination with other countries.

(4) It is integrated with research, management and technical support to implement Chinese Antarctic data management in accordance with the international framework, involving all related project, institution, staff, etc.. It is based on advanced technical equipment and methods, and scientific management is the key to ensure it successfully.

(5) It is a perpetual and constant project, which should be fulfilled in accordance with the international general requirement, technical standard, arrangement of operation. Meanwhile, realistic questions, such as funds and relevant national plan should be given consideration. So dealing with this dilemma considerately is a long way to go and a process to improve gradually.

To implement Antarctic data management in China is a complex and comprehensive issue, as is not only planned according to the international framework, but also combined with Chinese-specific conditions. The preliminary study of Chinese Antarctic data management is only the first step of the whole stage. Following this, a series of problems are required to deal with and accomplish as planned. We will present its development in succession for discussion.

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