Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Environmental Sciences 12 (2012) 1144 – 1150

Procedia Environmental Sciences

2011 International Conference on Environmental Science and Engineering (ICESE 2011)

China Offshore Data Translation Net and Information Integration and Release Platform*

Chen Yonghua

Institute of Oceanology, Chinese Academy of Sciences ,Qingdao, Shandong Province, 266071, China
yonghuachen@yahoo.cn

Abstract

China offshore marine observation station of Chinese academy of scienc1es consists of dozens of marine observation buoy system, which are spread in China's offshore to obtain the long-term continuous oceanographic elements. In order to get the real-time understanding of marine dynamic change information, the observed data need to be translated back on time to the terrestrial laboratory and the scientists can analyze them. By the communication way of general packet radio service(GPRS), code division multiple access(CDMA) and "Beidou" satellite, a large range of data transmission network of covering China offshore area is formed and the real-time observation data and the buoy state information is transmitted to ground-based data station. In ground-based station, the data received software is compiled and installed, which make the data are received and displayed. In addition, in order to better use the data, original database is needed and the primary data products are formed. At the same time network information release, establish data sharing mechanism. It is mature database software, established the real-time database and delay database, they have abundant data query function, but were established based on the Internet data information release and communication system, to scientists and government decision makers, fishery breeding personnel and the public users provide different levels of data information products for its service, and provide an exchange platform.

Keywords:ocean data translation net; information integration and release platform; China offshore observation station.

* This research was supported by the National Natural Science Foundation of China under Grants No. 41106084 and No. 41106083.

 doi:10.1016/j.proenv.2012.01.400

1. Introduction

Ocean information is the main guarantee for marine scientific research, ocean engineering design, ocean planning and management, ocean environment evaluation, and marine economy sustainable development. Therefore, marine scientific data collecting and processing, and database construction and information release have the significant scientific significance and pressing demand of the country. Early traditional marine automatic observation level is low, which made it difficult to achieve long-term continuous and real time ocean environment data. In 2009, in order to obtain the continuous China offshore environment information, China offshore observation research system is constructed. The system consists of China yellow sea observation station, China east sea observation buoy, and its corresponding regional environment cross-section survey and emergency observation. Distribution of China offshore marine observation site is shown in fig. 1.

Figure 1. Distribution of China offshore marine observation site

In order to acquire the real-time data of the system and take full use of the data, we carried out the information construction to establish data transmission network between the marine observation buoy sites and ground-based data received station and make the data of the buoy transmit to the data terminal real-time. The data received station is used for data collection, display, preliminary handling, storage and information integration management, Thus we can provide all-round, multi-level oceanographic information service for policy makers, scientific research personnel and the public users, which is useful for scientific research and the local economy development. The data translation net and information integration and release platform is shown in the fig. 2.

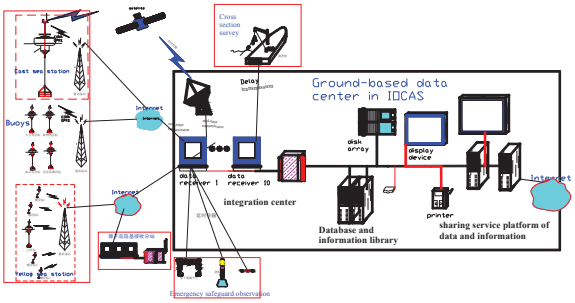

Figure 2. Design of data translation net and information integration and release platform

2.System design and implementation

Based on the above requirements, a high-performance marine monitoring data transmission network and real-time information publishing system is designed and implemented. It can provide automatic data collection, transmission and storage, processing and analysis, data products publishing and sharing, and remote dynamic monitoring of the observation sites. Compared with the traditional manual monitoring and semi-automatic monitoring system, the system is of very big enhancement.

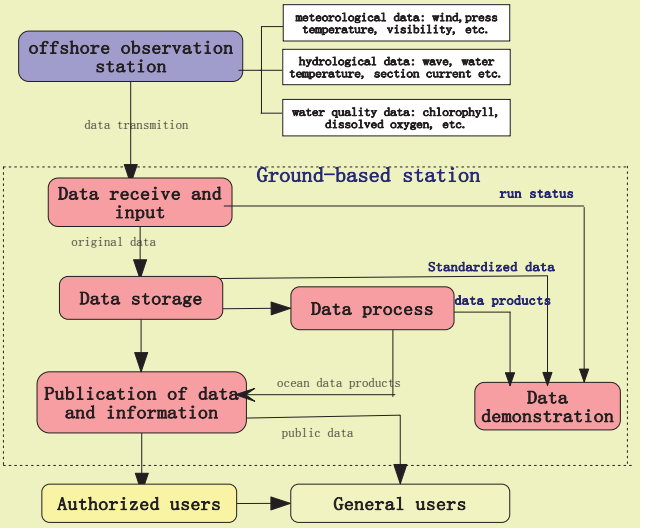

Figure 3. Overall design of informatization

Information construction of China offshore observation research system mainly includes: A).The construction of multi-factor automatic acquisition and processing platform; B).The layout of network of wireless data transmission; C).Foundation of database and platform of data product; D).Construction of service platform for data sharing and standardization information.

2.1.The construction of multi-factor automatic acquisition and processing platform

Each Marine observation site obtains dozens of parameters, and because of the different style sensor, the parameters is different each other. At the same time, in order to facilitate transmission of the real-time data, all parameters is needed to make unified handling and sent to real-time communication module. Two single chips are used to design and manufacture the multi-elements automatic acquisition and processing platform. It has many interfaces and large storage and the parts include data storage module, real-time clock module, analog conversion module, multi-serial port acquisition module and power supply module, and so on. It can realize data automatic acquisition, storage, manipulation, transmission, and other functions. According to certain sequential control mainframe and adding electricity to sensor or not, the automatic acquisition and processing platform will collect and process all kinds of sensor signals, store the data and send them to a user's terminal.

2.2.The layout of network of wireless data transmission

Because of long-serving, poor working environment, offshore further, it is difficult to use the traditional wired communications to transfer the observed data. Here we adopt wireless communication for real-time data transmission, which can overcome the disadvantages above. The methods of wireless data

transmission include GPRS, CDMA and "Beidou" satellite. These communication modes can send the buoy data to ground-based support data terminal on time. As below:

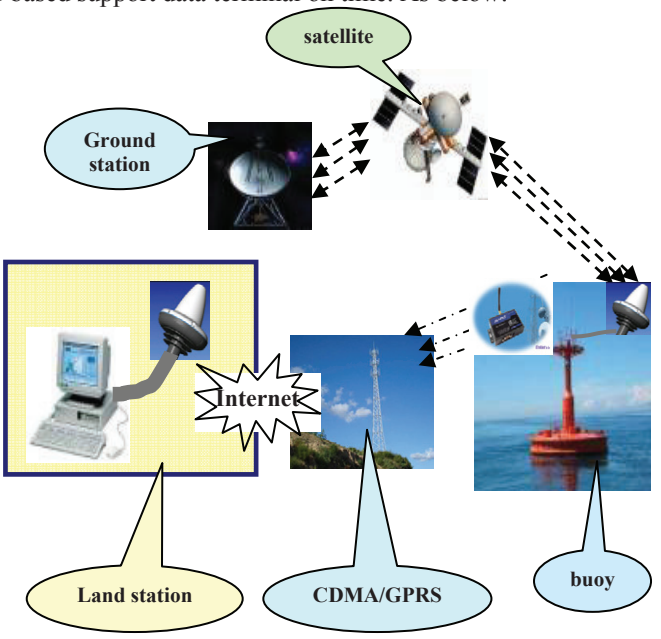

Figure 4. Methods of data transmission

In observation buoy system, we have data transmission unit (DTU) of general packet radio service (GPRS) and code division multiple accesses (CDMA). The DTU will send the observation data to GPRS and CDMA network, which can make the data be interactive and transmitted to internet. The data on internet will be sent to certain IP which is set in advance[1]. The ground-based support data receiving software is set up on the computer on land station with the IP. Through internet from the system control end, we get real-time data and information sent from buoy. At present, all buoy systems are set up GPRS and CDMA wireless data communication terminal and communications antenna[2]. In order to guarantee receiving rate of the data far from shore side, the "Beidou" satellite communication system is set on them. "Beidou" satellite communication system is all-in-one PC, It must be deployed on buoy and land station respective[3]. At present, we have installed two sets of "Beidou" satellite communication on two buoy systems, and set up "Beidou" communications user's machine and receiving antenna on land station[4].

Thus through the communication methods of CDMA, GPRS and "Beidou" satellite, we set up the wireless data communication network spread in China yellow sea and China east sea. More than 10 marine observation buoy's data are transmitted to nearby land station landed on Dalian ZhangZi island, Rongcheng Chu island or Qingdao Institute of Oceanology.

2.3.Foundation of database and platform of data product

Data receiving software is set up on the server in ground-based terminal. Through the data receiving software, real-time data and information of each observation sites are received. The data include ocean climate, hydrology, water quality and other status information of buoy system (e.g. water alarm, hatches opened alarm, low power supply voltage alarm etc.). Receive interface of real-time data and information is shown in Fig.5.

Figure 5. Receive interface of real-time data and information

Except receiving the real-time data through CDMA, GPRS and satellite communications methods, other data such as import cross-section survey data, combination dive marking observation data and emergency safeguard system observation data are automatically loaded or manually input to the data center. With these data, China offshore marine observation research network original database is established. Original database's structure is shown in Fig. 6. According to sources, data are divided into four parts which are buoy data, cross section survey data, internal standard data, and emergency safeguard observation data. Each part is divided into several data table according to different data types, such as buoy data have meteorological data: wind, temperature, visibility, etc; hydrological data: wave, water temperature, section current, etc; water quality data: chlorophyll, dissolved oxygen, etc. Section investigation has hydrological data: wave, temperature and salinity, ocean currents, etc; water quality data: chlorophyll, dissolved oxygen, nutrient etc; biological data: zooplankton biomass, sediment relevant data, etc. Dive standard data is mainly the hydrological data such as profile ocean currents, water temperature, tide, etc; Emergency safeguard observation data have hydrological data: temperature and salinity, etc; water quality data: chlorophyll, dissolved oxygen, nutrient etc. This is useful for data's arrangement, inquiry and classification.

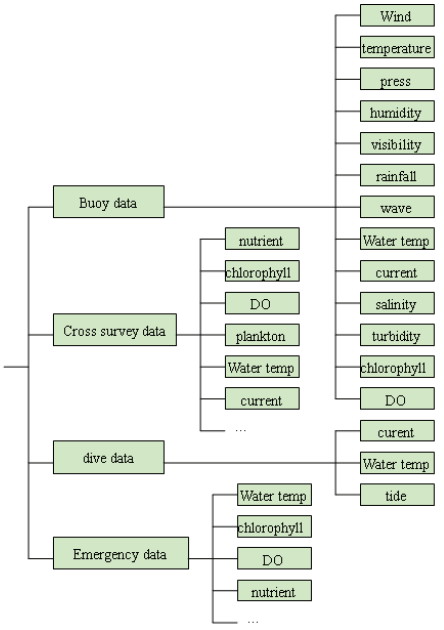

Figure 6. Structure of riginal database

Finally, distributed object-oriented and internet real-time database and delay database is establish. Real-time database is updated automatically once an hour and hold only one month after the data is received. Object-oriented programming technology and database connection technology are used to establish the application service subsystem of time-lapse database, in spite of real-time database based on development. Library of data products are consist of marine environment stereoscopic observation, statistical analysis, special service information. The form of products may be time process chart, frequency chart, histogram, vector diagram, isograms, etc.

Through a good data model, all kinds of information and products are effectively organized into product libraries. The various products is voluntarily warehoused, updated and built automatically. Because the products have many forms such as text, graphics, images, video and audio, the database structure must be built to support all kinds of data formats, including the text data, graphics data, sound data, electronic data etc. According to the form of information and products, products in accordance with the time, site and type are respectively stored.

2.4.Construction of service platform for data sharing and standardization information

Data sharing is an application service of operating type of observation data. Based on treatment of renovation, extraction, conversion and purification, we carry out the information sharing in developing and implementing heterogeneous multi-source. On the base of real-time database and delay primitive things of observation area and related sea marine environment, we develop a set of closely integrated data warehouse and platform, which can unify mass multi-source, heterogeneous data of marine environment and be shared on internet.

Standardizing information is mainly that on the base of hardware and operating software of data center we provide sharing service using the data, information and product. The sharing platform is made from the traditional “client/server” two layer structure to “backend server - application server – client” three-layer structure. Thus marine environment information service system is developed to provide observation data and information products browsing, searching and downloading services and so on. Structures of data sharing and standardization information service platform are shown in Fig. 7.

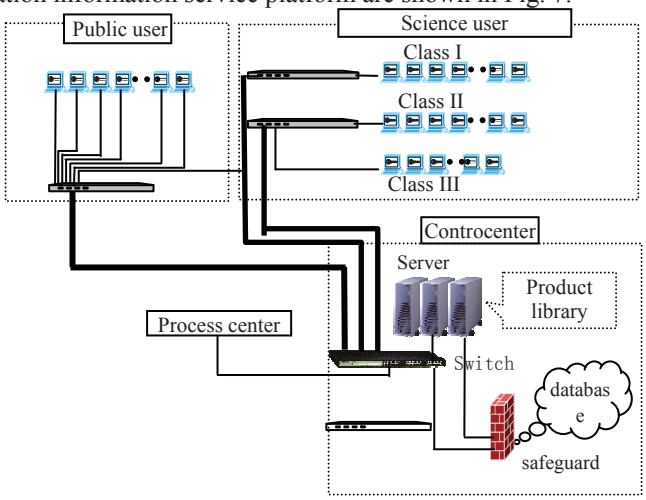

Figure 7. Structures of data sharing and standardization information service platform

Main interface of information release is shown in Fig. 8.

Figure 8. Main interface of information release

3.Summary

Construction of the data transmission and information platform of China's offshore marine observation is not only helpful for government decision makers to make the right decision and for development of the regional economy, but also is helpful for public users better understanding of marine dynamic change. Since long time ago, ocean data acquired through a variety of means is stored in different places, and their data formats are not identical. Thus it is inconvenience to use them. This platform will bring all kinds of data of Chinese offshore marine observation research system such as data of buoy system, data of regional section survey, and data of dive marking observation, data of emergency safeguard observation and so on together. Based on these data, the primary data products are produced and through the internet they are released. In any place, everyone can conveniently acquire the observation data and primary data products on the internet. At the same time, the system provides a good platform for all kinds of persons to carry out information communication, which makes scientists sit in the lab, makes the government and enterprise policymakers sit in the office and makes public user sit at home to get the real-time understanding of China's offshore sea change information. The system provides data resource for scientists and the social public offers a variety of types of data sets, special database and data products. Thus is useful for the sharing of China's offshore data and China ocean science research.

During the run process of the information system, the group of project point certain person to keep watch on "round-the-clock" and ensure the network of data transmission and the information system of releasing running smoothly.

Acknowledgment

I thank senior engineer S.R. Li and engineer J.B. Jiang for technical help. This research was supported by the National Natural Science Foundation of China under Grants No. 41106084 and No. 41106083.

References

[1] Y. W. Xu, “Application design of GPRS module GR47 in data transmission,” Journal of modern electronic technology, vol.15, no.1, pp: 23-25, 2005.

[2] J. J. Zhang, W. P. Jiang, C. L. Zhang, Y. C. Wang. “Application of GPRS/CDMA wireless communication technology in GPS data transmission,” Meteorological science and technology, vol.35, no.1, pp: 139-142,2007.

[3] F. L. Cheng, G. X. Deng, Y. F. Zhang, "Application of the Beidou navigation system in marine hydrology, meteorology monitoring system;," Marine technology, vol.23, no.3, pp: 70-73, 2004.

[4] S. Ning, G. X. Deng, F. Li, “System design of marine environment monitoring data real-time transmission based on Beidou system,” China's sustainable development. 2010.