THE SOFTWARE FOR
OCEANOGRAPHIC DATA MANAGEMENT – VODC FOR PC 2.0

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SUMMARY   To manage and process a large amount of oceanographic data, users must have powerful tools that simplify these tasks. The VODC for PC is software designed to assist in managing oceanographic data. It based on 32 bits Windows operation system and used Microsoft Access database management system. With VODC for PC users can update data simply, convert to some international data formats, combine some VODC databases to one, calculate average, min, max fields for some types of data, check for valid data…

PHAÀN MEÀM QUAÛN LYÙ DÖõ LIEÄU HAÛI DÖÔNG HOÏC – VODC FOR PC 2.0

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Taùm taét   Ñeå quản lý và xử lý một khối lượng dữ liệu biển lớn, người sử dụng cần có những công cô höõu hiôu nhaèm ñôn giaûn hãa quaù trình thực hiện. VODC for PC là phần mềm thiết kế cho việc quản lý dữ liệu biển. Chúng hoạt động trên hệ điều hành Windows 32 bit. Với VODC for PC người sử dông cã thô :

- CËp nhËt sè liôu mét c¸ch ®¬n gi¶n.
- Chuyôn ®æi qua l¹i gi÷a mét sè ®Þnh d¹ng d÷ liôu biôn trªn thô giíi.
- Keát hôïp nhiều cơ sở dữ liệu VODC thành một.
- Tính các trường trung bình, min, max đối với một số loại d÷ liôu.
- Kiểm tra chất lượng số liệu.
   ...

INTRODUCTION

For a long time in Vietnam, the oceanographic data were distributed at different offices, and stored in different formats. In general, the way to manage data in these offices was not the same so it was very difficult to exchange or combine data. There were some softwares used to update and manage data (such as Ocean-PC from IOC, SDM from Institute of Oceanography…), but none of them was powerful and flexible enough to manage the large amount of diverse oceanographic data.

Therefore, finding a new model and tool for more effective management of oceanographic data now in Vietnam is extra necessary.

In order to create Oceanographic Data Bank of Vietnam, a software package, called VODC (Vietnam Oceanographic Data Center), was built at the Oceanographic Data Department of Institute of Oceanography. It was supported by the National Project KCN-06.01 on establishment of Vietnam Oceanographic Data Bank. The VODC software package consists of three parts:

- VODC for PC (P. Quang, V.V. Tac, N.M. Tien, L.V. Khin. V.V Lanh, D.N. Thanh, 1999).
- VODC for Network (P. Quang, V.V. Tac, N.M. Tien, L.V. Khin. V.V Lanh, D.N. Thanh, 1998).
- VODC Home Page (P. Quang, V.V. Tac, N.M. Tien, L.V. Khin. V.V Lanh, D.N. Thanh, 1999).

The VODC for PC 2.0 is the newest version of VODC for PC and has been developed at the end of 1999. It based on 32 bits Windows operation system and its content consists of two main parts:
- VODC Database: is a warehouse, which store all the real data.
- User Interface: consists of a plenty of functions to access to VODC database.

This paper describes the main structure and some important functions of VODC for PC 2.0.

VODC DATABASE

The VODC database is created on Microsoft Access database management system. It can store the inventory of data and 11 following real data type groups:
1. Physic/Chemistry
2. Level water
3. Current
4. Meteorology
5. Geology
6. Pollution
7. Phytoplankton
8. Benthic plant
9. Zooplankton
10. Zoobenthos
11. Fish larvae-eggs

The data inventory (or catalog) is information about real data that were collected on certain platforms or cruises. It includes 3 types of information:
- Platform/Cruise information
- Locations of stations pointed on the platform/cruise
- Data types collected on that platform/cruise

In the database the data inventory is stored in three tables, which link to each other by some relations:
1. CRUISE_HEADER
2. CRUISE_LOCATION
3. CRUISE_DATA_TYPE

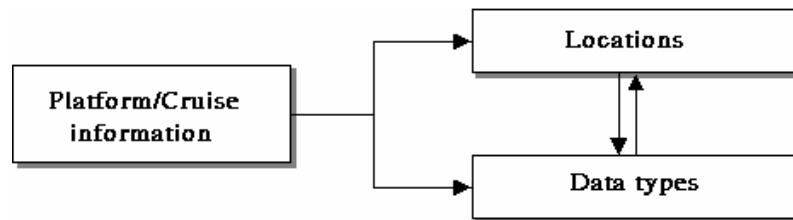The following schema shows how to manage the data inventory.

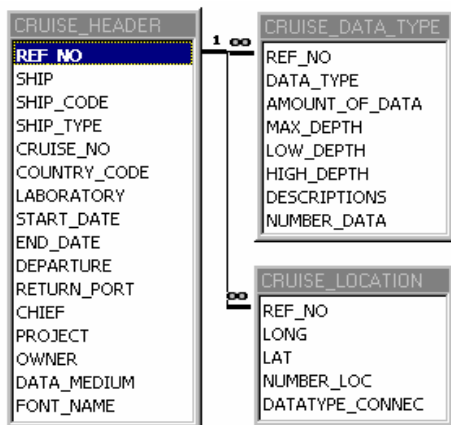*Figure 1*: Schema of the data inventory management

Figure 2: The schema of relationship between inventory tables

Where:
1-1: One to one of relation type
1-∞: One to many

VODC for PC manages the real data by a basic object, which is called "measured station". It was defined as below:
- Each station must have the determined position (longitude, latitude) and times (day, time).
- Each station may have one or many types of data.
- A station is continuous if it has the time-series data (such as current, water level…).
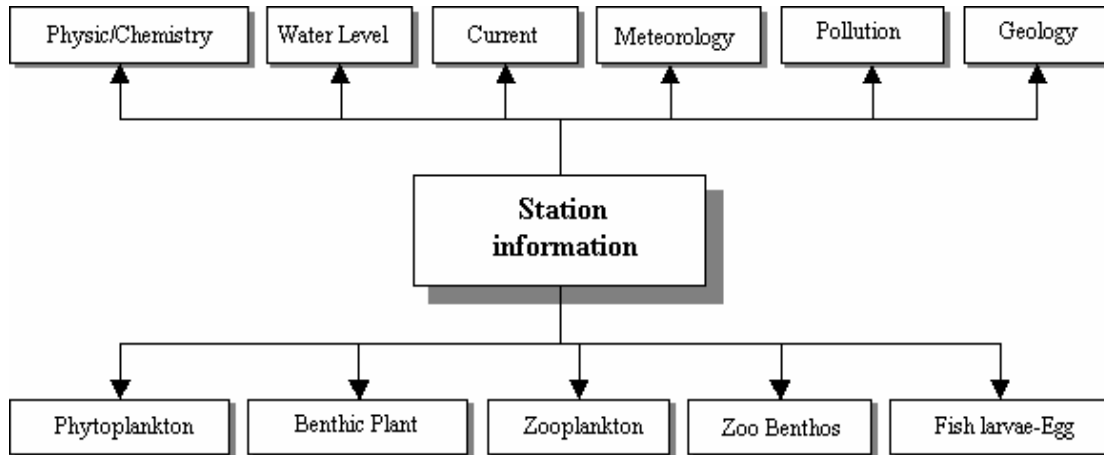
The following schema shows how to manage the real data:
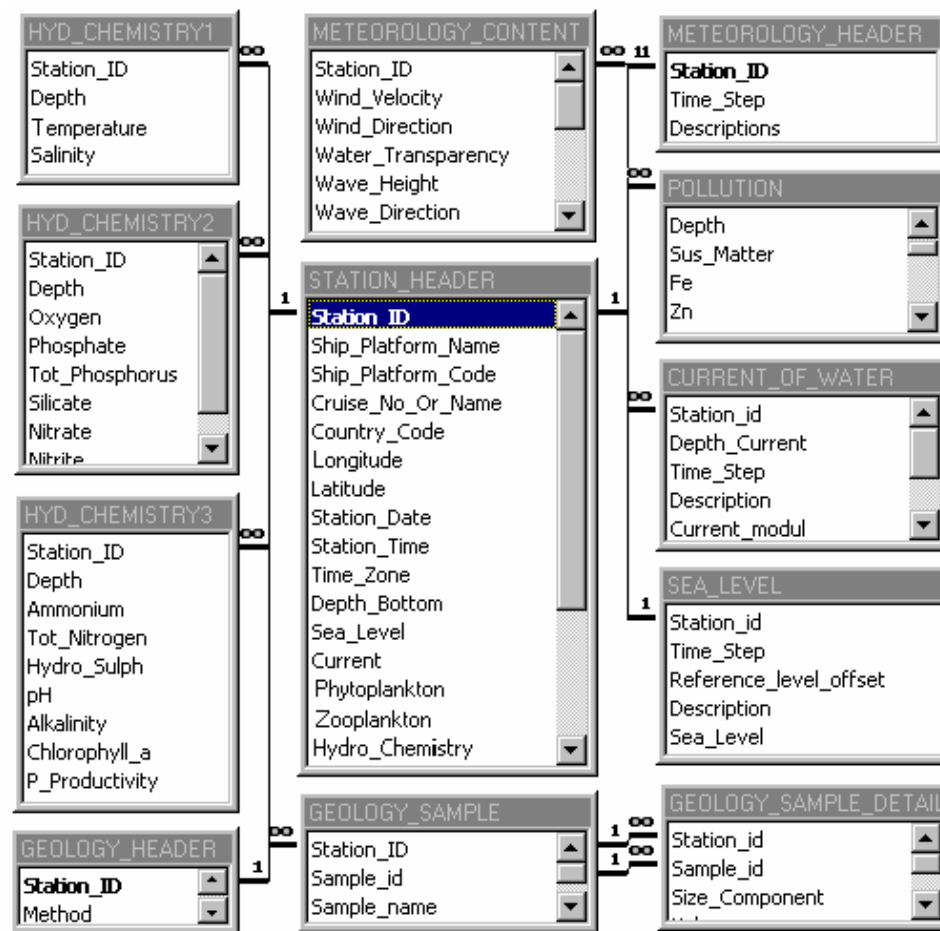
Figure 3: The schema of the real data management

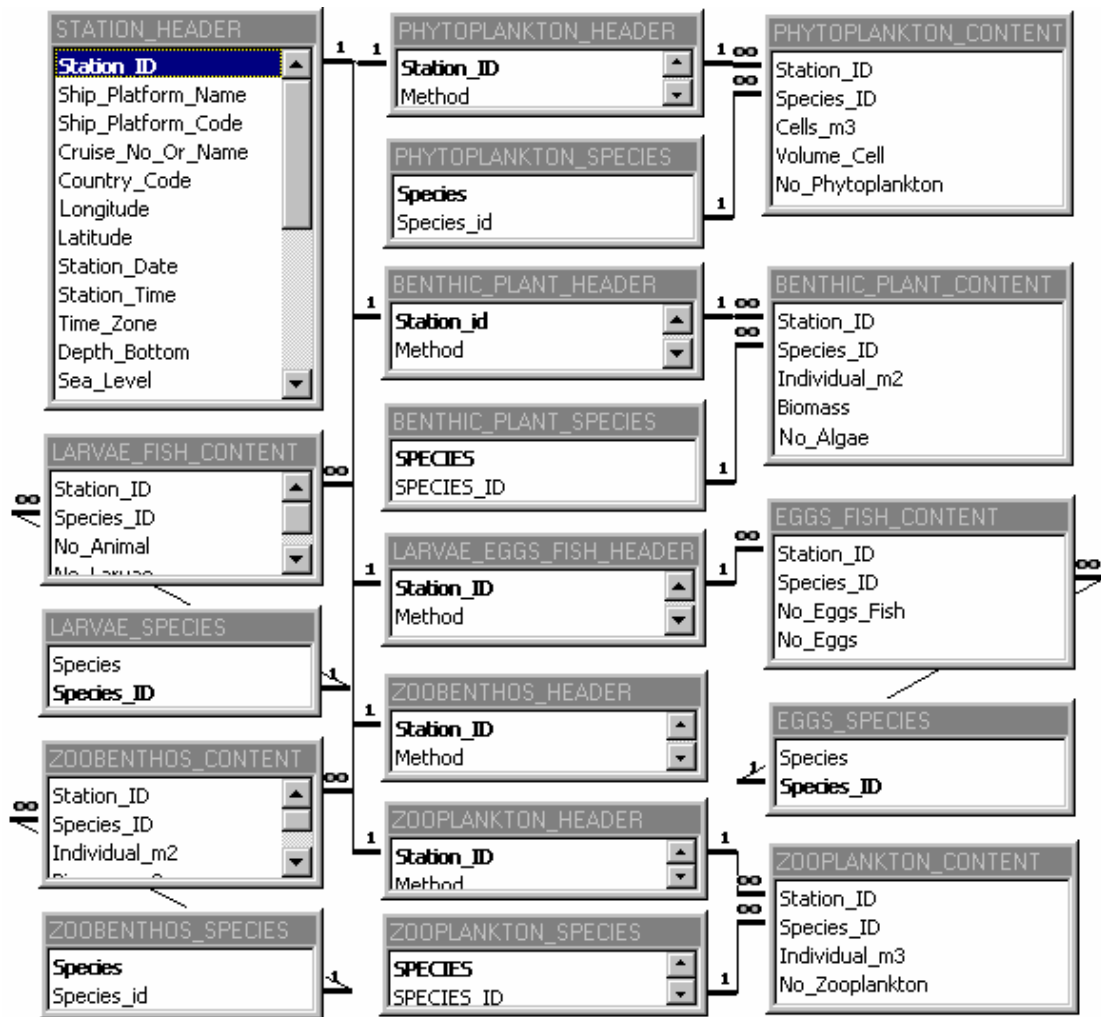**Figure 4**: The schema of relationship between real data tables (1)

Figure 5: The schema of relationship between real data tables (2)

The schema of relation between data tables was divided into two for easy to look (Figs. 4 and 5). The real data was stored in 29 tables:

1. STATION_HEADER
2. HYD_CHEMISTRY1
3. HYD_CHEMISTRY2
4. HYD_CHEMISTRY3
5. POLLUTION
6. SEA_LEVEL
7. CURRENT_OF_WATER
8. METEOROLOGY_HEADER
9. METEOROLOGY_CONTENT
10. GEOLOGY_HEADER
11. GEOLOGY_SAMPLE
12. GEOLOGY_SAMPLE_DETAIL
13. PHYTOPLANKTON_HEADER
14. PHYTOPLANKTON_CONTENT
15. PHYTOPLANKTON_SPECIES
16. ZOOPLANKTON_HEADER
17. ZOOPLANKTON_CONTENT
18. ZOOPLANKTON_SPECIES
19. BENTHOS_PLANT_HEADER
20. BENTHOS_PLANT_CONTENT
21. BENTHOS_PLANT_SPECIES
22. ZOOBENTHOS_HEADER
23. ZOOBENTHOS_CONTENT
24. ZOOBENTHOS_SPECIES
25. LARVAE_EGGS_FISH_HEADER
26. FISH_LARVAE_CONTENT
27. LARVAE_SPECIES
28. FISH_EGGS_CONTENT
29. EGGS_SPECIES

- Some other objects of VODC database (such as fields, integrity rule…) were not discussed in this paper. The interested reader is referred to the report of KHCN-06.01 Project (P. Quang, V.V. Tac, N.M. Tien, L.V. Khin. V.V Lanh, D.N. Thanh, 1998) for further details.

USER INTERFACE

As shown above, VODC user interface consists of many forms and functions to help users access to VODC database. The connection from user interface to database based on DAO (Data Access Objects) of Microsoft Jet database engine (Fig. 6). DAO is an object of Microsoft Access; it enables us to use a programming language to access and manipulate data in local or remote databases, and to manage databases, their objects and structures.
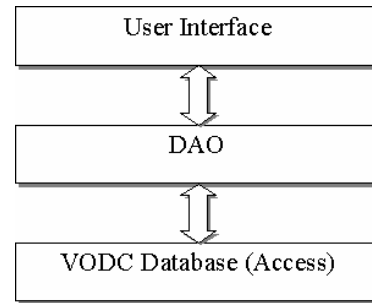
Figure 6: DAO in VODC for PC

In the following, we present a brief outline of main functions of VODC for PC 2.0. All the forms of VODC are shown in two languages: Vietnamese and English. There are three main functions, which users can clearly find on the main form of VODC (Fig. 7).

Figure 7: The main form

In "Data Inventories", users can input or update the data inventory easily as the other windows application. A record consists of 4 parts as shown in inventory form (Fig. 8):

- Platform/Cruise information
- Locations of platform/cruise
- All data types in platform/cruise
- Detail location for data types

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VODC for PC has supported many options for users, so they can access to data comfortably. Furthermore, in all data edit forms, the users can exchange data with many popular softwares such as Word, Excel… so it is much easy to input or update data.

There are two types of report in data inventory. The first one is summary about a certain platform/cruise (such as data types, the path map of cruise…) and the second is one-degree grid distributed data map of the South China Sea (Fig. 9).

Figure 8: The inventory form

"Data Management" is an important function, which manages all real data in VODC database. As above mentioned, VODC can store 11 data type groups. Each group has a separate form for editing data; it locates on separate tab in real data form. In these forms, users can input, correct or find data easily. When users input a new record, VODC always checks whether data is valid or duplicate. This is a powerful utility for managing a large amount of data.

VODC for PC can convert the data from VODC database to 2 international oceanographic data formats:

- ICES (International Council for the Exploration of the Seas)
- NODC (National Oceanographic Data Center)

In real data form, user can also export the data to text format and surfer format file, calculate average, min, max values for some types of data…

The automatic quality control procedures were included in VODC for PC version 2.0. These procedures were used to check the valid data by examining the entire database and marking a validated flag to all stations.

An advanced function is ability to combine two VODC databases to one and it was "add from other VODC database" function. In the process of operation VODC will check for duplicated data. This utility is powerful tool for using distributed oceanographic data management model.
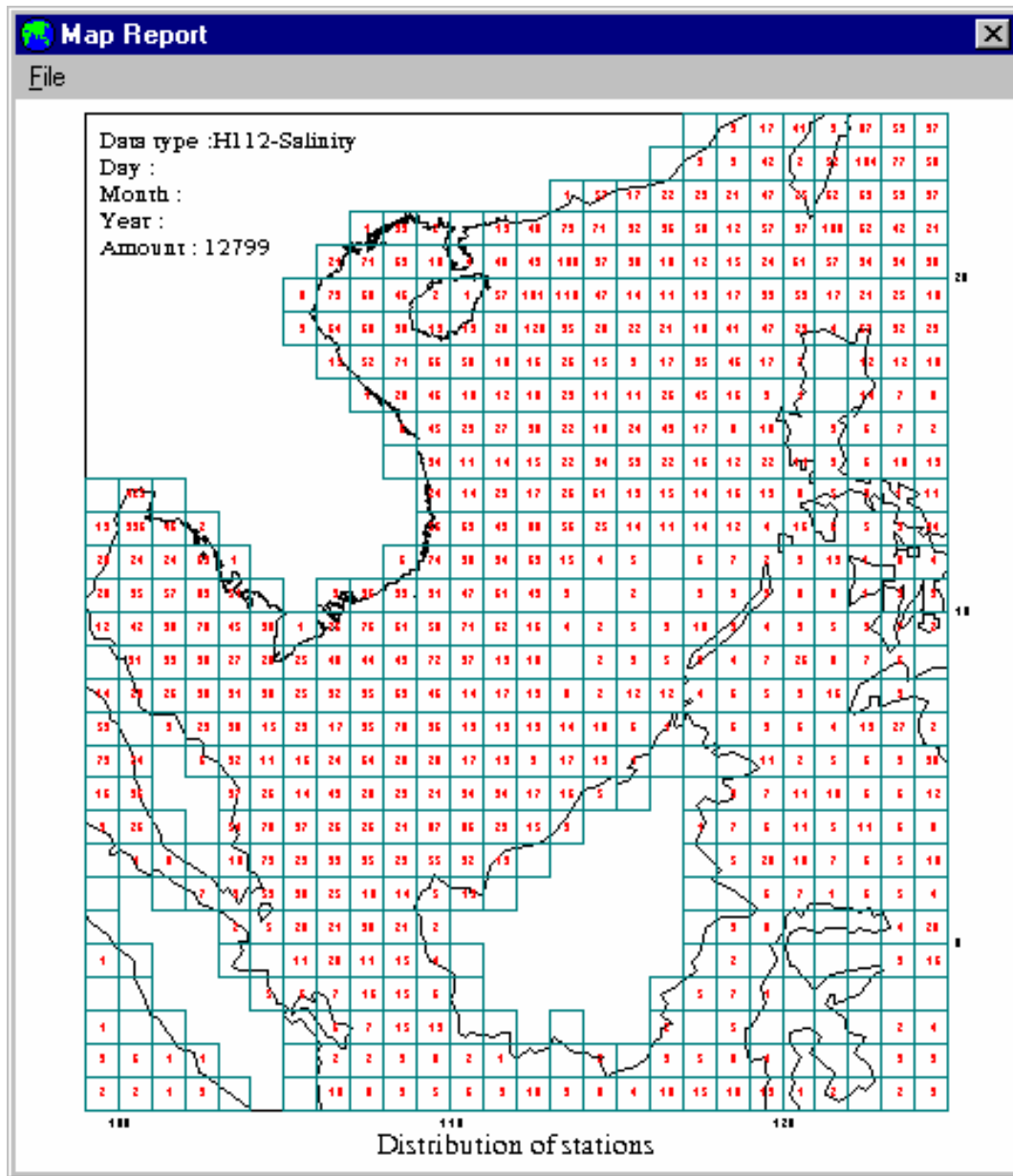
Figure 9: A report map

CONCLUSION

After testing and using at some offices for building local database, VODC for PC 2.0 proved an effective tool to manage diverse oceanographic data. It provided many flexible functions for accessing data; processing speed was very fast… However, it also has some disadvantage such as:

- There are very little graphic functions for data report,

- Data quality control is not checked for all data types in VODC database…

In the future, VODC for PC will be upgraded to overcome above weak-points.

Figure 10: The real data form

REFERENCES

1. Phan Quang, Vu Van Tac, Ngo Manh Tien, Lau Va Khin, Vo Van Lanh, Dang Ngoc Thanh, 1999. VODC for PC 2.0 - Appendix to the report of KHCN-06.01 Project. (In Vietnamese)

2. Phan Quang, Vu Van Tac, Ngo Manh Tien, Lau Va Khin, Vo Van Lanh, Dang Ngoc Thanh, 1998. VODC for Network - Appendix to the report of KHCN-06.01 Project. (In Vietnamese)

3. Phan Quang, Vu Van Tac, Ngo Manh Tien, Lau Va Khin, Vo Van Lanh, Dang Ngoc Thanh, 1999. VODC Home Page – Appendix to the report of KHCN-06.01 Project. (In Vietnamese)