THE MANAGEMENT OF THE MULTI-SCALE SPATIAL DATA IN DIGITAL EARTH

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Abstract This paper states that it is necessary to research and develop the management and display of multi-scale spatial data. The technologies, that are the generalizing technology and the processing technology of spatial data, are designed for the selection of multi-scale spatial data. Also, the principle of these technologies to be realized is described.

1 Instruction

The topographical environment of DSS is based on the multi-scale spatial information so that leader acquaints him with information of topographical environment in area from macroscopic state to microcosmic state. The paper map provides the spatial information of region by some scale map. It is too difficult to select the multi-scale spatial information in paper map for DSS. It is possible for leader to obtain the multi-scale spatial information for DSS by establishing some scale map database and using multi-scale selection technology of spatial information. With the development and completion of theory and technology in the multi-scale selection of spatial information, people can obtain random-scale or multi-scale spatial data on some scale spatial databases. For example, in case the map databases of 1:500000 and 1:250000 scale are provided, the

spatial data of 1:450000 or 1:300000 and so on scale between 1:500000 and 1:250000 can be acquired by using multi-scale selection technology of spatial information.

Because of high cost-consuming and time-consuming, it is no necessary to establish a lot of scale spatial databases. The key of the management and display in multi-scale spatial data is the selection of multi-scale spatial data .The multi-scale spatial data is selected by using the generalizing technology and the processing technology of spatial data.

2 the generalizing technology of spatial data

It is a complex technology for the selection of the multi-scale spatial data in Digital Earth. Owing to complicated geographic feature and different description of cartographic generalization rule for the spatial information, the selection of the multi-scale spatial data relies on advanced cartographic generalization model、 spatial database theory、 AI and GIS technology. This paper states some key technologies that propose the selection of the multi-scale spatial data in Digital Earth. These key technologies are described below:

2.1 the spatial database

There are some spatial databases of a few basic scales which contain 1:10000、1:2.5000、1:50000、1:100000、1:250000、1:500000、1:1000000. It is necessary to build up a few basic scale spatial databases, which are an important foundation to process the multi-scale spatial information. The selection of multi-scale spatial data is based on these basic scale spatial databases.

2.2 the classification of geographic entity

The classification of geographic entity is established by using the object-oriented technology. It is possible to create the structural framework of spatial information by the classification of geographic entity that is an important foundation to establish spatial databases.

2.3 the code of the geographic entity

Also, the code of the geographic entity is a key foundation. The attributive characteristic of the quality and quantity on geographic entity is graded in term of the code of the geographic entity. The computer can identifies the primary and secondary of the different geographic entity so that the geographic entity can be automatically accepted or rejected.

2.4 the generalization model of the spatial information

The generalization model of the spatial information is important for the selection of multi-scale spatial data. The basic characteristic of the map generalization is researched. The rule, which information of geographic entity increases or decreases with change of map scale, is explored. The aim is to construct the selection model of the quantity, to construct the selection model of the content and to construct the generalization model of the geographic entity.

① The selection model of the quantity

According to the scale of new map、the scale of old map、the quantity of geographic element and the significance of geographic element, the selection quantity of geographic element is determined by the selection model of the quantity for the spatial data.

② The selection model of the content

Based on the selection quantity of geographic element and the code of the geographic element, those geographic elements can be selected by the selection model of the quantity and the selection model of the content.

③ The generalization model of the geographic element

With lessening of scale of the spatial data, it is impossible to display detail structure of the geographic element. The structure must be outlined in order to stand out the main structure of the geographic element by using the generalization model of the geographic element.

2.5 the map symbolic base of the spatial information

The map symbolic base of the multi-scale spatial information is key step for the display of multi-scale spatial data. It is necessary to build up

the management system of map symbolic base for different application in GIS. After computer proposes the multi-scale spatial information for the geographic element, the map symbol is automatically mated for the geographic element.

3 the processing technology of spatial data

In the processing of spatial data for the selection of multi-scale spatial information, based on the content of old map, according to the selection model of the quantity and the selection model of the content, the selection quantity of geographic element and the content of geographic element are determined. In according with the criterion of map compilation and the best effect of map display, the spatial map data is outlined and is outputted. The key technologies of the processing of spatial data are explained below:

3.1 to determine aim of the application

User can determine the application demands that contain the geographic element、the thematic element and the region scope.

3.2 to determine the scale (M) of new map

According to the region scope and map size to be decided by user, the scale (M) of new map can be calculated. It is a precondition for the processing of spatial data.

3.3 to determine other two scales (M1 and M2)

The spatial databases have a few basic scales which contain 1:10000、1:2.5000、1:50000、1:100000、1:250000、1:500000 and 1:1000000. M1 and M2 represent two scales of these basic scales. M1 is less than M2. If M is between M1 and M2, as a rule, the map of new scale (M) should be produced on M1. If the map of new scale (M) is close to M2, the map of new scale (M) should be produced on M2.

3.4 to determine the origin of spatial data

The origin of spatial data is equal to a few spatial databases, that are map databases of the scale as 1:10000、1:2.5000、1:50000、1:100000、1:250000、1:500000 and 1:1000000. According to M, the

spatial database of the scale as M1 or M2 is selected as the origin of spatial data.

3.5 to process spatial data with classification of geographic element

The code of the geographic element is an important foundation. The attributive characteristic of the quality and quantity in geographic element is graded. The computer can identifies the primary and secondary of the different geographic element so that the geographic element can be automatically accepted or rejected.

3.6 to generalize the spatial data

According to the scale of new map、the scale of old map、the quantity of geographic element and the significance of geographic element, the selection quantity of geographic element is determined by the selection model of the quantity for the spatial data. Based on the selection quantity of geographic element and the code of the geographic element, those geographic elements can be selected by the selection model of the quantity and the selection model of the content. With lessening of scale of the spatial data, it is impossible to display the detail structure of map graph. The structure must be outlined in order to stand out the main structure of the geographic element by using the generalization model of the geographic element.

3.7 to integrate the multi-layer spatial data

After the processing of spatial data as single geographic layer for the selection of multi-scale spatial information, it is necessary to overlay multi-layer geographic element under unified geographic system of coordinate. Because the placement error is created in the generalization of single geographic layer, the relationship among the multi-layers of geographic element must be processed.

3.8 to mount map symbol

The map symbol is a language to represent geographic element. Under different geographic application and different map scale, there are different

map symbols for different geographic elements. According to the theory of modern cartography, it is key task to study the symbolic database of multi-scale map for the multi-scale spatial data.

3.9 to decorate map

The quantities of old geographic element have been reduced by the spatial data processing that is put forward above. Now, the quantities of new geographic element match to new map scope and scale. In order to represent the character of exterior outline of geographic element, the new map must be decorated.

3.10 to output map

In according with the criterion of map compilation and the best effect of map display, the spatial map data is outputted.

The chart of processing functional flow for the management and display of multi-scale spatial data is drawn below:

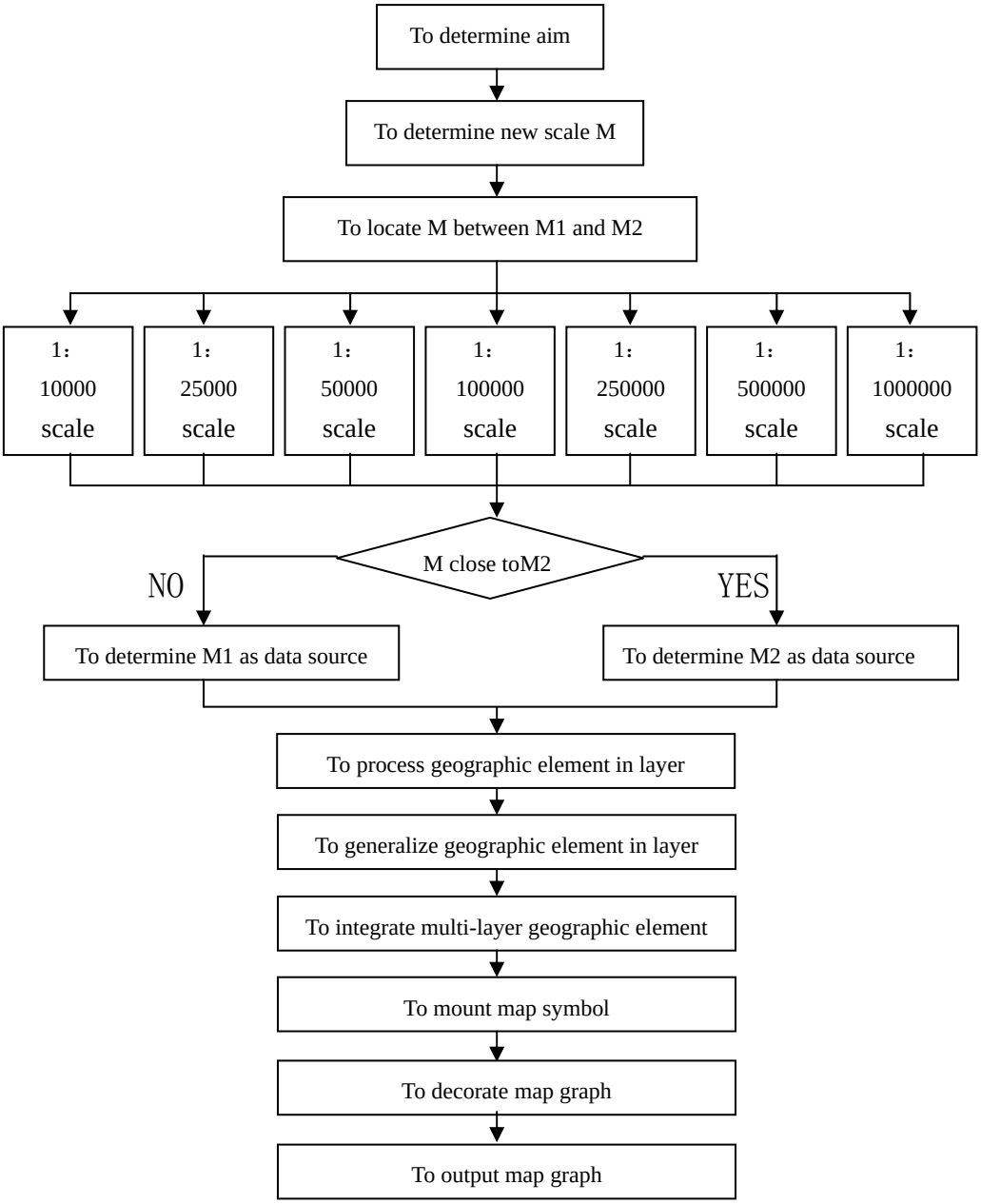

Fig.1 The chart of processing functional flow

4 Conclusion

So far, the theory and technology of the management and display of multi-scale spatial data is begun to study. Its purpose is to support the development for the digital earth development、the spatial data integration and the spatial DSS. Hence, we should catch hold of this good opportunity to study and establish the management and display of multi-scale spatial data for supporting our country NSDI.

CONFERENCE

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