

Constructing the Historical Database of Administrative Division

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1. Introduction

China, which has a long history, owns various literature documents to describe its history. And many scholars devote to exploring the stories behind the historical data only emphasizing the time dimension (Lin Hui and Zhang Jie 2006). While GIS comes into our eyes, it provides a new perspective to study these with the integration of space and time dimensions (Gregory I N and Kemp K K 2001, Holdsworth D W 2003, Paul S Ell and Ian N. Gregory 2001). Now historical GIS, short for historical geographical information system brings the geographical sense into history, and has made some progress right now: according to specific format requirements, the time and spatial attributes, together with the geographical spatial data analysis can show by establishing historical GIS database (Anne Kelly Knowles 2002, Delve J and Allen M 2001).

Now many countries have their own historical GIS (Lewis R Lancaster and David J Bodenhamer 2002, Berman M L 2005, Fitch C A and Ruggles S 2003, Peter Bol, Jianxiong Ge 2005, Siebert L 2000), such as the Great Britain Historical Geographical Information System which displays the changes of administrative boundaries as the time goes by. As each boundary has a start date and a deadline, it can reflect the administrative boundary in a given period, and can be connected with statistical data based on time and space to show the changes of the historical data (Gregory I N and Ell P 2005).

Setting up an administrative division historical database, not only can effectively manage records, but also can reflect the changes of administrative divisions over time. As a result, it can be more convenient for the public.

2. The Analysis of Administrative Division Historical Data

2.1 Administrative Division Data

One of the difficulties that GIS applied in history field is that the historical spatial information is hard to locate in modern maps (David Rumsey and Meredith Williams 2002). Specifically, the historical data are got in accordance with the administrative divisions at that time. All statistical data related with administrative divisions will be effect by the region sizes at that time, so the diversity of the special data is related to the administrative division scopes and boundaries.

As the place names and administrative borders are always changing, their attributes would never be the same. After measuring the administrative districts demarcations, a lot of accurate documents, data, pictures and topographic maps and other materials are got, together with the various scales digital raster graphic (DRG) and digital line graph (DLG). It is so not very easy to manage such large amounts of data.

2.2 The characteristics of Administrative Division Historical Data

The relevant administrative division historical data contain the place names, administrative districts demarcations, administrative districts thematic maps, administrative districts historical archives and administrative districts texts. While administrative division changes include: administrative districts attribute changes (partition, merger and adjustment etc.), ownership changes, and the creations of administrative districts or the disappearances of the administrative division ,and so on. By analysing the characteristics of the administrative division historical data, the historical GIS can show the history based on the present situation, with the aim to effectively design specifications and reasonable database, as well as the classifications and coding standards.

Administrative division historical data have the following features:

(1) Complexity: the data come from widely various kinds of sources, especially topographic maps and documents. For example, digital raster maps, digital line graphics, digital orthophoto maps, and administrative boundaries agreements, reports and approval documents and boundary registration forms, result tables, work summaries, etc. always have the different scales and coordinates, projections and publication years.

(2) Diversity: except for the literary data, there are a lot of different precisions of modern and historical maps. Different scale topographic maps still exist overlapping. Furthermore, the publications, publishers, projections coordinate systems are different. For historical maps, in view of the surveying and mapping condition that time, there are so many gaps between history and now. In addition, the choices of the surveying and mapping rules and regulations, as well as the drawing of technical routes, lead to

the different results. What's more, a small group of topographic maps are not following the measure standards.

(3) Hierarchy: in space dimension, there are different levels of authorities like the province, city and county. In time dimension, the data are recorded by the different dynasties, years or others. According to considering the characteristics of historical data, the use of nodes can reveal the administrative districts changes, and manage historical data by different users.

(4) Relationship: for the reason that all kinds of administrative districts data are not independent, the contacts should show users that, when administrative districts changed, the demarcations, administrative centres, place names, ownerships and their relations changed corresponding.

3. Building Administrative Division Historical Database

3.1 Integrating Administrative Division Historical Data

Historical data has the characteristics of incomplete and timeliness as the analysis above. The use of historical GIS can achieve organization and specialization of the historical data, as the help to reflect the historical appearances, improving the historical data management, instead of the traditional storage and retrieval management (Ian N Gregory and Richard G Healey 2007, Wilson A 2001). All this will be controlled by computers, in order to save space, overcome the disadvantage that the paper materials can be damaged easily. The integration of space information and electronic maps can promote the original archives management to the digital, visual management. That the data stored in historical database, greatly improve efficiency by the convenient query, registration, alteration, cancellation (Gaffield C 2007, St-Hilaire M and Moldofsky B 2007).

Due to the historical data collected usually have a loss and fuzzy uncertainty, so the history GIS would make errors during data processing. The solutions have the following three kinds: the mathematical, which is based on fuzzy logic, using the existing accurate data to assess the uncertain ones, such as creating Uncertain Temporal Entity Model; the representational, through the survey data to create a grid that every pixel's attribute values is calculated by the adjacent values; the documentary, by the way of making metadata standards to reduce error and redundancy (Ian N. Gregory and Richard G. Healey 2007).

3.2 Database Establishment by Geodatabase

The Geodatabase can organized and combined administrative division historical data and other related data: using data validity rules, including attribute domain rules, relationship rules and connection rules, and spatial topological relationships and class can realize the connect between the data. As the result of using historical GIS, the historical information distributed in different regions, got from different sources and

different platforms, can be integrated in the administrative division historical GIS database. According to object-oriented data model, the Geodatabase can organize the multi-scale data for the purpose of seamless storage.

This database includes several classes, such as administrative division place names, administrative division demarcations, administrative division thematic maps, and administrative division archival data and so on. By the mean of the object-oriented technology, the organization of all above can be done, to form a "smart" database. Then we proposed the standard framework, like the base maps and spatial standards, data stratified and naming standards, data encoding and metadata standards and others. That giving attentions to the existing administrative division database and administrative division demarcation management system is necessary to make the effective database.

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