A GIS-BASED SPATIAL MANAGEMENT AND ANALYSIS SYSTEM FOR RURAL SOCIO-ECONOMIC STATISTIC DATA

Jian Lian[1, 2], Xiaojuan Li[1, 2], Huili Gong[1, 2], Dan Meng[1, 2], Zhiheng Wang[1, 2], Ronghua Wang[3]

1. The Key Lab of 3D Information Acquisition and Application, MOE, Beijing 100048, China;
2. Capital Normal University, Beijing 100048, China;
3. Graduate School for International Development and Cooperation，Hiroshima University, 1-5-1 Kagamiyama, Higashi-Hiroshima, JAPAN

1. INTRODUCTION

The rural socio-economic statistic data of China is in abundance now. The survey of rural socio-economic can be divided into four parts, including conventional survey, statistical reports, special investigation and agricultural census in terms of survey approaches; in addition, there exist daily reports, monthly reports, yearly reports and so on according to the rural socio-economic statistic system in terms of time[1]. With the rapid development of database technique and computer technology nowadays, it is no longer a difficult problem to manage mass statistical data with computer and database system. However, from the statistical mode and time series of rural socio-economic statistical survey, we know that the statistical data have both spatial and temporal attributes, so the traditional systems have no enough ability to manage and analyze the spatio-temporal statistical data.

On the basis of rural socioeconomic statistic data which has spatio-temporal attributes, with geographical information system (GIS) technique to construct a spatial management and analysis system is regarded as a better method to solve the mentioned problem. Reviewing the existed systems which have some relationship with the research aspects in this paper, it was displayed that many current studies have focused on survey and mapping [2], land use [3] or vital statistic [4], etc., but these systems are not suitable for the complicated rural socio-economic statistic data; in addition, the techniques involved in existed systems have no enough ability to fulfill the real demands of rural statistic department.

In this paper, on the basis of the former research and the real demands of rural socio-economic statistic department, four key techniques about the construction of spatial management and analysis system for rural socioeconomic statistic data were designed. Based on the statistical spatio-temporal database, historical statistical data spatio-temporal division, statistical model library, exploratory spatial statistical analysis method techniques, the integrative operational system was realized for spatio-temporal data management, analysis and thematic mapping or expression. It could be utilized in many aspects of operational work of rural socio-economic statistic administration.

2. KEY TECHNOLOGIES

2.1. Construction of statistic spatio-temporal database

There exist many types of database for storing socio-economic statistic data now, however, these databases always lack of considering spatial factors [5]. As we know, the amount of socio-economic statistic data is huge, and its index system is complex. Meanwhile, these data take year, quarter, month and so on as time series, take administrative divisions as statistic units, the two characters demonstrate that the socio-economic statistic data have temporal and spatial two attributes, so we should research the spatio-temporal data model and construct spatio-temporal database then for statistic data. In this paper, taking these characters as mentioned above of rural socio-economic statistic data into account, integrating current various statistic system, the Time Snapshot-Relationship Mapping Model (TSRMM) was designed and realized, and the statistic spatio-temporal database was constructed based on this model.

2.2. Research on spatio-temporal partition for historical statistical data

As mentioned above, socio-economic statistic data have spatio-temporal two attributes, but they will encounter some barrier when we will do backdate query and historical contrast analysis for statistical data, because there always happen administrative divisions change including merge, split, regionalism and so on in existence of realities. Therefore, in this paper, on the basis of construction of statistic spatio-temporal database, taking the spatio-temporal partition for historical statistical data as research target, integrating various types of administrative divisions change, two modes were adopted to record and solve backdate query and historical data contrast analysis questions, one is by specified proportion mode and the other is by lower administrative divisions mode, then the table of change records of administrative divisions were recorded and achieved.

2.3. Research and design for statistical model management platform (SMMP)

On the basis of traditional statistical operation and current statistical operational flow, the statistical model management platform (SMMP) was researched and designed [6]. On the platform, with integrating the statistical operational flow and spatial information processing flow, the spatio-temporal statistical data processing flow was designed, and the statistical model components and statistical model library were constructed with the support of multi source spatio-temporal data.

2.4 Exploratory spatial statistical analysis methods

Spatial analysis always adopts classic statistical method but ignore the exclusive character of spatial data, the data violates random sampling and independent sampling which belong to theory foundation of classic statistics based on its spatial dependency [7]. At the same time, the traditional spatial statistic techniques are almost static in nature, which determined that the interactive agree among data, model and analyzer is limited. With the

development of exploratory data analysis method and it's integrated with earth information science, the exploratory spatial statistical analysis method was introduced.

Integrating with theory of spatial statistics and graphics expression, the exploratory spatial statistic analysis technique reveals the regional and variable rural socio-economic spatial statistic data.

3. SYSTEM FUNCTION COMPOSITION

Based on the above system key technologies and running mode, the system functions were categorized into four levels.

Level 1: The data management functions;

Level 2: The model functions;

Level 3: The analysis functions;

Level 4: The operational application functions.

The upper level functions were deployed on the basis of its lower level functions.

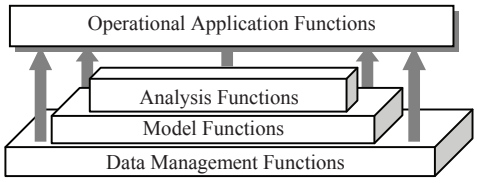

Fig.1 The function hierarchy of prototype system

4. PROTOTYPE SYSTEM DEVELOPMENT AND CONCLUSION

We cooperated with China National Bureau of Statistics and accomplished the spatial management and analysis system for the agricultural census data on the basis of above techniques research and developing idea. The system adopts client/server structure to construct spatio-temporal database, and the database have the ability of storing massive data. To facilitate the data management, it provided multiple ways to query and search data. At the aspect of operational works, the prototype system has extensible modules about the spatio-temporal statistical data management, statistical model construction, spatial statistic analysis and so on. The system has had very good utilization effect in the practical application until now.

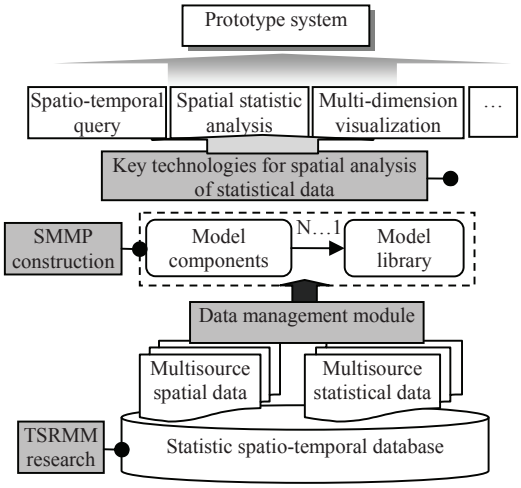

Fig.2 Technical framework of prototype system

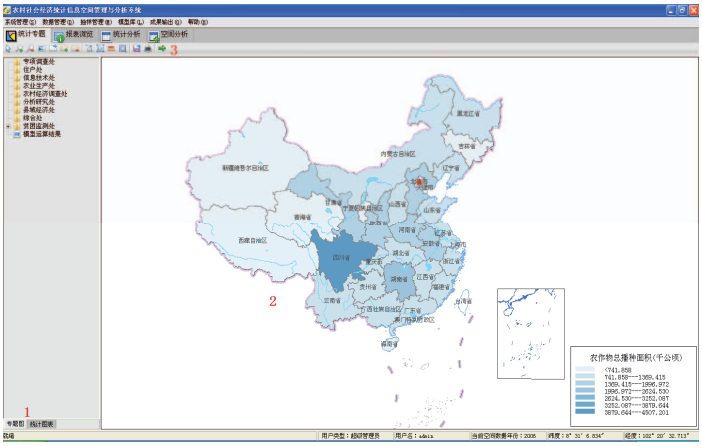

Fig.3 Effect of prototype system running

5. REFERENCES

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