RESEARCH ON INTEGRATION OF SDI WITH GEOLOGICAL AND METEOROLOGICAL DATA FOR METEOROLOGICAL FORECAST AND ALARM OF GEOLOGICAL DISASTERS

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ABSTRACT:

In order to forecast the geological disaster, a forecasting model of geological disasters in Hefei area has been established. The model is based on raster data model. Because that the data from local SDI are vector data, some pretreatment must be done before they are used in the forecasting model. Some data, such as geological data, meteorological data and precipitation, has been translated into grid network data, which grid cell is 5Km×5 Km. In order to integrate these professional data with the data from local SDI, a new integrating way has been put forth in this paper. In our case study, the forecasting model has been used to forecast the geological disasters in Hefei area successfully by using the integrating way. The successful running of this forecasting model demonstrated that this integrating way is feasible and can be used for reference of integrating other professional data with SDI data.

1. INTRODUCTION

1.1 Introduction

China is one of the countries that the geologic disasters are most serious. More than 1000 people were killed and almost ten billions of Yuan's property were lost yearly because of geologic disasters in recent years according to statistics. It is necessary to establish a forecast and alarm information system of geologic disaster for decreasing the loss caused by geologic disasters. Because that the happening of geologic disasters is correlative to geographic space information, precipitation and geologic conditions and so on, it is necessary to integrate the above data seamlessly with the forecast and alarm model of geologic disasters. Because the model is based on raster data structure, it is not easy to integrate the geological and meteorological data based on vector data structure with the model. Some new integrating technologies were applied successfully to solving this problem and a practical forecast and alarm information system based on GIS has been established in Hefei Area.

1.2 Introduction of Geographic Space Information Which Came from the Local Spatial Data Infrastructure (SDI)

As we all known, data are the blood of GIS. The geographic data are the basic data of GIS and always organized into many different data layers, such as road layers, building layers and so on. There are 14 layers in our research data came from local SDI, and all the data have been pretreated according to the requirement of GIS.

Although the geographic space information are classified into different layers and stored in the format of AutoCAD, most of them can not be used directly in GIS. There are two main kinds of problems in the data from local SDI. The first is some layers are not divided according to GIS principle. For example, some different kinds of features often are divided into a layer, which always can not meet the needs of GIS. T   he second is topological problems. Because that most of the electronic map are made by the people who know a little or even nothing about GIS, there always are many topological mistakes in these maps,

such as open polygons, overhung arcs, and so on. In order to use these kinds of data in GIS, we must spend a lot of time to pretreat them. At present, these kinds of problems commonly exist in the data of electronic map from local SDI.

All of the layers in our research project are classified into 3 main types. The first is geographic feature layer, which includes 6 layers. The second is geological and engineering geological feature layer, which includes 4 layers. The third is geological hazard feature layer, which also includes 4 layers.

Geographic feature layer is the basic geographical layer. These basic information layer provides information about the map, such as the map's name, scale and so on. Other important layers include water layers, traffic layers, resident spot layers, administrative boundary layers and contour layers.

1.3 Introduction of the Geological Data

There are 5 main geological data layers which include fault layers and engineering geological lithology group layers, subareas of geological disaster layers and so on. All of them are vector data and some of them were made according to data collected from field investigation. For example, the subareas of geological disaster layer (Fig. 1) were made according to data of the geological investigation, and used to calculate the classified value of geological disasters. Figure 1 shows the distribution of subareas of geological disaster. The High Zone means the possibility of occurring geological disaster is relatively high, while the Lower Zone means that is relatively low.

1.4 Introduction of the Meteorological Data

There is a meteorological data layer called precipitation layer involved in our research project. It includes all the precipitation observation stations which can provide the precipitation of last 24 hours every day in our research area. There are totally 38 precipitation observation stations. Because that our forecast and alarm model of geological disasters is based on raster data structure, the research area has been divided into grids which area are 5Km×5Km. A precipitation raster layer has also been

established using the same grid network parameters. The main parameters of the grid network can be seen from the following figure (Fig 2). There are 460 grid cells in all in the research area.
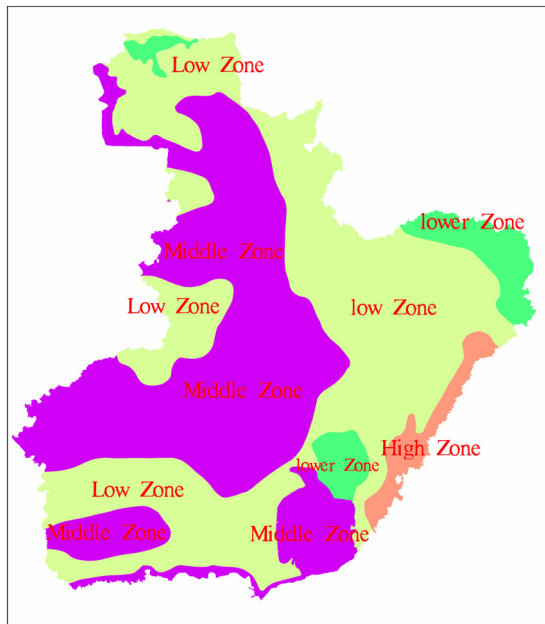

Figure 1. Distribution of subareas of geologic disasters in Hefei Area Anhui Province

Figure 2. The main parameters of grid network

2. INTEGRATION OF SDI WITH GEOLOGICAL AND METEOROLOGICAL DATA

2.1 Establishment of Grid Network

Because that the forecast and alarm model of geological disasters is based on raster data structure, the research area has also been divided into grids which area are 5 Km×5Km. Each grid cell has its own forecasting and liminal precipitation and belongs to a specific subarea of geologic disasters.
In order to integrate the geological and meteorological data with the SDI data, the following grid layers has been established with

the same grid parameters. They are intraday forecasting and liminal precipitation grid layer, and five-day forecasting and liminal precipitation layer.

2.2 Integration of SDI with Geological Data

In our case study, one of the most important factors that puts premium on geological hazards of Hefei Area is geological conditions. In order to integrate the geological data with SDI, a geological raster layer which includes the geological conditions has been established by using the same grid network parameters mentioned above. The raster layer has been made according to the field investigating data, and a map called geological disasters' subareas map (Fig. 1) has been made by use of DTM analyzing functions of GIS. This map can be used to identify the intraday and five-day liminal value of precipitation.

2.3 Integration of SDI with Meteorological Data

Two raster layers of liminal precipitation have been made according to the geological disasters' subareas map, which has the same grid parameters mentioned above. The liminal precipitation means the minimum precipitation that may cause the happening of geological hazards.
Another two of the most important factors that put premium on geological hazards of Hefei Area are intraday and five-day forecasting precipitation.
Intraday forecasting precipitation means the forecasting precipitation of the forecasting day from intraday 20:00 pm to 20:00 pm in next day. Five-day forecasting precipitation means the summation of intraday forecasting precipitation and four days' practical precipitation before the forecasting day. It is necessary to consider the five-day forecasting precipitation because that the precipitation affects the geologic disasters lingeringly. Some geologic disasters occur even when the rain has stopped for a long time.
Another two raster layers of forecasting precipitation has also been made according to the data of precipitation observation stations, which also has the same grid parameters mentioned above.
There are totally 4 raster precipitation layers that includes intraday forecasting and liminal precipitation layer and five-day forecasting and liminal precipitation layer.

2.4 The Meteorological Forecast and Alarm of Geological Disaster

A practical forecast and alarm information system of geologic disaster has been established by using the above 4 raster layers of precipitation, which demonstrated that the integrating way is feasible and efficient.
In order to issue the subareas map of easiness of geologic disasters happening to the issue in a simple and visual way, the classified value of easiness of geologic disasters happening has been classified into 5 grades, including the forecasting grades of blue and green, and the alarming grades of yellow, orange and red. Therefore, the subareas map of easiness of geologic disasters happening can be drawn out automatically by using the DTM functions of GIS COM called MAPGIS. The subareas map can be used to issue the forecasting and alarming information. But only the alarming subareas including yellow, orange and red alarming subareas are issued to the publics by Hefei TV weather forecast program at 6:50 pm in the forecasting evening or the Web sites of the Bureau of Land and Resources of Hefei City (figure. 3). Figure 3 shows that there are 3 red alarming subareas, 2 orange forecasting subareas and 4

yellow forecasting subareas issued to the public in this forecasting and alarming map. The green and blue forecasting subareas were not shown in figure 3. According to the type of geologic disaster forecasting and alarming information, corresponding actions should be taken to avoid the loss of property and human being. For example, if the red alarming information were issued, the people live in the red geologic disaster alarming area should evacuate as soon as possible while the people in yellow geologic disaster alarming areas only need to pay attention to the areas where geologic disaster will occur easily and the change of precipitation.
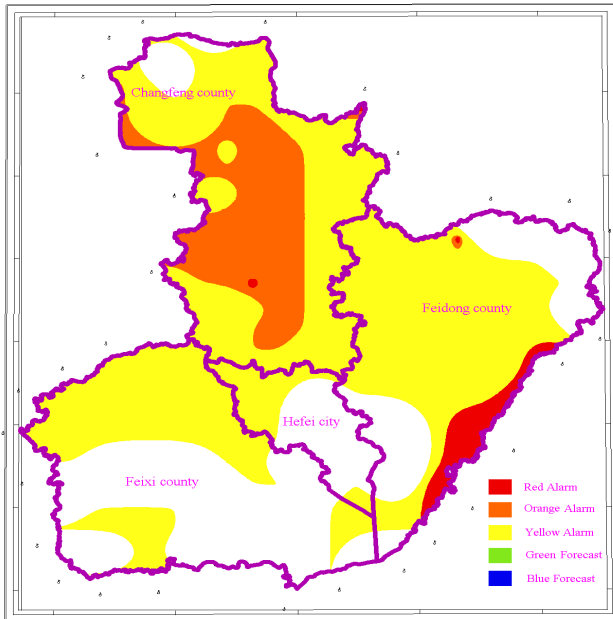

Figure3. The forecast and alarm result of geologic disaster in Hefei Area

3. CONCLUSIONS

Although the data from local SDI always need to be pre-treated, they are very useful for some practical applications. It is obvious that some important things, such as the format of data, classification of data and so on, should be considered carefully when the SDI data are made. Our case study shows that even the vector SDI data can also be integrated with raster geological and meteorological data successfully. This integrating way can be used for reference of integrating SDI data with other professional data in some other practical applications.

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