Study on Automatically Plotting Contours Method Based on MapInfo and Surfer

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Abstract. Contour is a powerful tool of analyzing spatial characteristics of geographical factors. The traditional hand-drawing style had been eliminated and much professional mapping software had its own flaws and shortcomings as well. So, how to integrate the functions and advantages of various mapping software together so as to improve the efficiency of contour mapping is an issue which is worth of studying. This paper introduced a new method of plotting contours that adopts VB as developing-platform and utilizes OLE technology to carry out integrated development with MapInfo and Surfer. This method had been applied widely during the protection and administration of ecological environment of mining area. The contours plotted in this way are relatively precise and it has greatly improved the efficiency of plotting actions.

Keywords: CONTOURS; OLE; MAPINFO; SURFER

1. Introduction

The contour line is a powerful tool for analysis of Geo-factor spatial characteristics. It can be used to grasp features of the spatial variation overall. The traditional contours are drawn by man, then modified and complete to fair drawing by professionals, but this approach is inefficient. With the development of computer software and hardware technology, the traditionally manual and experiential method has gradually been eliminated, replaced by a contour drawing of a variety of professional software, such as American Surfer and Matlab of Golden Soft and so on. In respect of drawing contour, a variety of professional GIS software, such as Arc / Info, MapInfo, etc., have their respective characteristics and advantages, shortcomings and deficiencies as well.

MapInfo is currently the most popular GIS software, due to its friendly interface, user-friendly control and powerful, so it is already used in range of urban planning, environmental protection and weather prediction, and has been widely recognized by users. However, the function of MapInfo is weak in contour drawing, so it is limited in the practical application. Therefore, Canadian company Northwood has developed a specialized contour drawing software——Vertical Mapper for MapInfo, it can be used with MapInfo together after being installed But it is found that the contours drawing method of this software is limited, for example, it generate the contours only through Delaunay triangulation interpolation and rectangular net interpolation, with a lot of restrictions in the actual use of the process was a lot of restrictions.

Surfer8.0 is small and practical three-dimensional drawing software, it has the following characteristics: (1)it can draw three-dimensional drawing, including contours through a series of x, y, z values of 3-dimensional graph drawing, including contour picture, and contour generation method almost includes all

methods of traditional drawing; (2) it can draw function image by such function as z = f (x, y) (Surfer can not draw 2-D function graph), has powerful functions of data processing; (3) it can read Excel files directly and get the interface with the Office; (4) it supports the digital map, once installing the digital instrument, Surfer process can be generated by digital electronic map; (5) it has perfect graphics labeling function; (6) the format of graph can be converted to a variety of graphics file formats. It is because of these characteristics, Surfer is powerful in the contour drawing. However Surfer also has its shortcomings in the drawing, the most critical two points: (1) the display and positioning of punctiform factors is poor; (2) layer function is weak. These two kinds of drawing software have each pluses and minuses, so it is a worthy research that how to combine the two play their strengths and become more efficient to draw a satisfactory contour [1].

This study will make use of OLE technology and called MapInfo and Surfer of VB in the actual work process, and developed and complete automatic drawing of contour by integration of the three.

2. Integrated isoclines rendering techniques

2.1. OLE automation
OLE automation is an interactive process for design communication mechanism makes an application drive or automatic completion of another application. OLE automation includes two parts, one is the application of exposure to the OLE components that can be controlled applications , called OLE automation server; Another is using OLE server of components providing the object to control operation of application, called the OLE customers. OLE automation can not only realize data exchange, but also can realize the commands operating to other objects. These objects have attributes and methods, programming staff who just to know contains the name of the object's application, classes of objects name, wanting to use the name of the attributes and methods can use automation server.

In this paper discusses contour integration development methods, development program as a receptionist will VB, also namely, OLE customers; Will Surfer8.0 and Mapinfo7.0 as background OLE automation technologies to realize server, through OLE relations between data exchange and software function integration.

2.2. Twelve interpolation methods of Surfe8.0 isoclines drawing
Surfe8.0 provides customers with inverse distance weighted interpolation method, Kerry gold interpolation method, minimum curvature method, improve x don't German, natural adjacent point interpolation method, the nearest point interpolation method, multiple regression method, the radial basis function method, linear interpolation triangulation net method, moving average, the forecast method of data measurement method and local polynomial interpolation method, total 12 kinds of methods. All the interpolation methods are basically covered in these currently interpolation methods.

Users can accord to the different characteristic of various data and all sorts of different analysis, scientifically choosing the correct interpolation methods of the parameters set, to generate grid files, and then draw the right and Meaningful isoclines. For example, carries on the surface precipitation analysis when standing nets enough dense, standing nets density low, can choose Tyson polygon interpolation, namely the nearest point interpolation method carries on the interpolation; For mountain or precipitation site is not very densely populated areas, is using the Inverse distance weighting method to improve the accuracy of predicted by data; when considering dimensional continuity change attributes very irregular, Kerry gold interpolation is just solving the problem.

3. The basic thought of contour line rendering

The basic principle of contour line rendering is through interpolation method to use the Attribute data of several discrete points in the space to generate a series of smooth curve which is named contour line. The attribute value of the same contour line is equal. There are many specific use of interpolation method, such as the minimum distance method and curvature method triangular mesh method, polynomial regression method, etc [2].

Using MapInfo and Surfer to integrate develop and realizing the both of the data format conversion is the key. Its basic train of thought is like that below: (1) rendering contour line. Firstly, open the contour line data

source table in MapInfo which should include monitoring stations in the geographic coordinates and some index concentration monitoring in value, and then derive the data table to text file (txt) format in MapInfo, choose the suitable interpolation method for the data of text files to grids, get standard GRD and use the grid files as base to draw contour line;(2) Introduce a base map. Open a table that include geographic coordinates of monitoring points in the MapInfo and then the tables to file of format mif, in the end switch the mif file to the map as the base surface; (3) Contour and base map overlay. select the contour map (contours) and the base map (base) in Surfer at the same time , then use the overlay function in Surfer to achieve superposition of the two, at last, turn the shaped map out in format mif and turn it into MapInfo to show [3]. Drawing process is completed. Contour drawing process shown in Figure 1.

```
┌─────────────────────────────────────────┐      ┌─────────────────────────────────────────┐
│ Introduce the Monitoring data table to  │      │   Introduce the base map to MapInfo     │
│                MapInfo                   │      │                                         │
└─────────────────────────────────────────┘      └─────────────────────────────────────────┘
                    ↓                                                  ↓
┌─────────────────────────────────────────┐      ┌─────────────────────────────────────────┐
│ Turn out the Monitoring data table in   │      │ Turn out the base map in the format mif │
│               txt format                 │      │                                         │
└─────────────────────────────────────────┘      └─────────────────────────────────────────┘
                    ↓                                                  ↓
┌─────────────────────────────────────────┐      ┌─────────────────────────────────────────┐
│    Grid the txt format files in Surfer   │      │ Introduce the format mif base map in    │
│                                          │      │              Surfer                     │
└─────────────────────────────────────────┘      └─────────────────────────────────────────┘
                    └──────────────────────────┬───────────────────────┘
                                               ↓
┌───────────────────────────────────────────────────────────────────────────────────────────┐
│ Overlay the contour map (contours) and the base map (base) in Surfer and turn the shaped    │
│                          map out in format mif                                              │
└───────────────────────────────────────────────────────────────────────────────────────────┘
                                               ↓
                        ┌──────────────────────────────────────────┐
                        │  Turn the shaped map into MapInfo to show │
                        └──────────────────────────────────────────┘
```
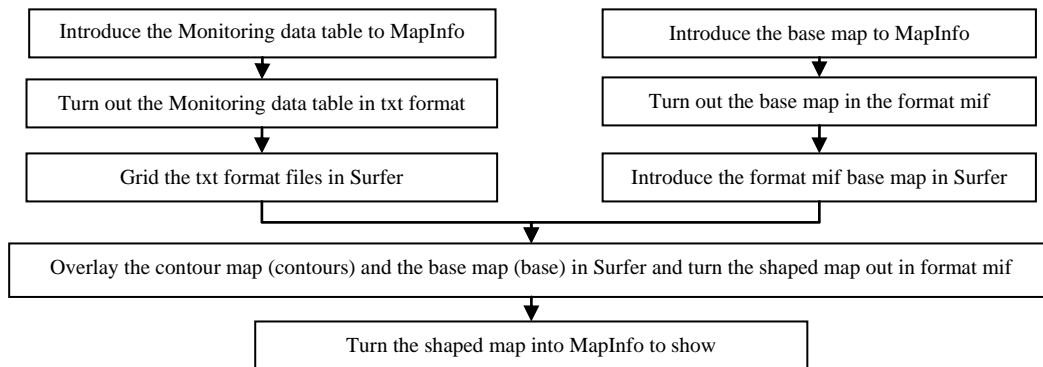
Fig.1. contours draw flowcharts

In the Surfer, the user can via the Properties dialog box to customize set the display parameters on the contour map of (contours) and the base surface figure (base) to match the user's habits and needs.

4. Application

In accordance with the thought of drawing contour line described above, take VB as development language and use the OLE technology integrate MapInfo and Surfer to draw contour map. Now take the TSP monitoring data of XinWen Mining Area in June 2007 as an example to introduce the automatic drawing procession of TSP concentration contours. Among them, "DZXJCSJ" is the document to store the measured values of TSP concentration in regional monitoring sites and it is the source of data to draw contours; "JCDSJ" is the document to store the location of each monitoring point and it is the data sources of the contour base map data. "DZX" as the base map and contour map superimposed upon the file, which will MapInfo the mapping and display.

4.1. Contour drawing

```
Dim mi,surferapp,plot As Object
Dim contourmapframe,contourmap As Object
Dim basemapframe,basemap As Object
Dim infile,gridfile As String
Dim basename,basefile As String
Set mi=CreateObject("mapinfo.application")
Msg1 = "set application window " & Pic1.hwnd
mi.do msg1
mi.do "Register Table """ & App.Path & "\xwsjk.mdb""  Type ACCESS Table "" DZXJCSJ "" Into """ &
App.Path & "\ DZXJCSJ.TAB"""
mi.do "open table """ & App.Path & "\ DZXJCSJ.TAB"" interactive"
Set surferapp=CreateObject("surfer.application")
surferapp.Visible = True
msg2= "Export "" DZXJCSJ "" Into """ & App.Path & "\ DZXJCSJ.txt"" Type ""ASCII"" CharSet
""WindowsLatin1"" Titles overwrite"
mi.do msg2
Dialog1.Filter = "Data File(*.txt)|*.txt"
Dialog1.ShowOpen
```

```
Dialog1.DialogTitle = "Select File"
infile = Dialog1.FileName
If infile = "" Then End
basename = infile
extstart = InStrRev(infile, ".")
If extstart > 1 Then basename = Left(infile, extstart - 1)
gridfile = basename + ".grd"
surferapp.griddata datafile:=infile, xCol:=2, yCol:=3,zCol:=4,algorithm:=3,
dupmethod:=srfdupnone,showreport:=False,
outgrid:=gridfile
Set plot =surferapp.Documents.Add(srfdocplot)
Set contourmapframe=plot.shapes.addcontourmap(gridfile)
Set contourmap = contourmapframe.overlays(1)
contourmap.fillcontours = False
```

4.2. Datum loading and overlying

```
mi.do "Export "" JCDSJ "" Into """ & App.Path & "\ JCDSJ.MIF"" Type ""MIF"" Overwrite"
Dialog1.Filter = "Base Map(*.mif)|*.mif"
Dialog1.ShowOpen
Dialog1.DialogTitle = "Select File"
basefile = Dialog1.FileName
If basefile = "" Then End
Set basemapframe =plot.shapes.AddbaseMap(basefile)
Set plot = contourmapframe.Parent
plot.Selection.DeselectAll
contourmapframe.Selected = True
basemapframe.Selected = True
plot.Selection.OverlayMaps
```

4.3. Display of contour in MapInfo

```
plot.Export FileName:=App.Path & "\DZX.mif", Options:="Width=1500, Height=1500"
mi.do "Import """ & App.Path & "\ DZX.mif"" Type ""MIF"" Into """ & App.Path & "\ DZX.TAB""
overwrite"
mi.do "set next document parent " & Pic1.hwnd & " style 1"
mi.do "Map From DZX "
```

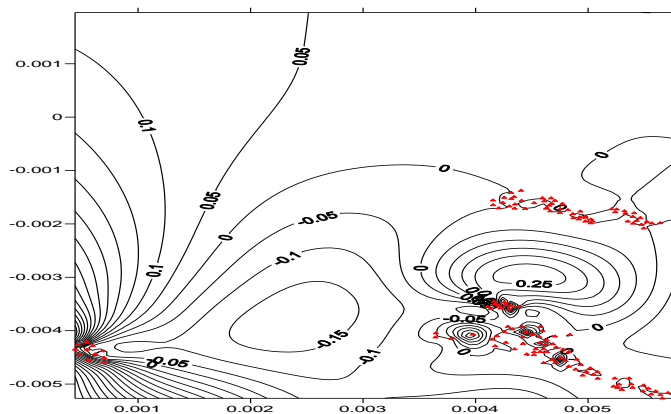According to the method described in this article, draw the contours shown in Figure 2.

Fig.2. contours of superimposed forming TSP concentration

5. Conclusion

By above discussion the following conclusions can be drawn: it is feasible that taking the VB6.0 as a development platform, using OLE Automation to call MapInfo7.0 background and Surfer8.0, making use of both technological and technical characteristics, to achieve the conversion between data formats and integrated development. In practice, the method can significantly improve the efficiency of contour drawing and has a strong practical value.

However, in practice this method still has many deficiencies, the automation of drawing processes need to be further enhanced. With the improving of the MapInfo and Surfer software capabilities, it is convinced that the integration between the two will more closely and the process of drawing contours will become increasingly easy and efficient.

6. References

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