

# Thematic Map Mapping Method and Mapping Software System based on Domestic Operating System

Yi Zheng<sup>1,3</sup>, Yang Liu<sup>1,2,3</sup>, Zhenzhen Chen<sup>3</sup>

<sup>1</sup>The 27th Research Institute of China Electronics Technology, Zhengzhou, Henan, 450047, China

<sup>2</sup>Central South University, Changsha, Hunan, 410083, China

<sup>3</sup>Henan Fangda Space Information Technology Co.,Ltd, Aerospace Systems Department, Zhengzhou, Henan, 450000, China

---

## Abstract

Aiming at the domestic operating system, this paper designed a thematic mapping method and mapping software system, which mainly includes several steps. Installing the drawing software system in the domestic operating system. Create thematic map making space. Establish a set of map symbols expressing elements. Establish and configure thematic map frame, and configure map coordinate system and scale. Establish the output template and decorate the elements outside the drawing. Configure output parameters and output high-resolution thematic map. Through the thematic map production method and software system based on the domestic operating system proposed in this paper, the production and output of thematic maps can be completed in the localization operating system environment, with the ability of map frame and external decoration, which solves the problem that common map mapping tools cannot complete the adaptation and deployment of the localization environment, and supplements the vacancy of the traditional thematic map method.

## Keywords

Domestic Operating System; Thematic Maps; Cartographic Methods; High Resolution.

---

## 1. Introduction

Maps are the best way to express elements of geographic information, and the rapid development of trends in various disciplines has put forward broader requirements for maps. As a map with extensive content and diversified functions, thematic maps open up a new field of map services with superior legibility and practicality [1].

Thematic map refers to the base map in accordance with the requirements of the map theme, highlight and improve the representation of one or more characteristics related to the theme [2], so that the map content is thematic, different forms of expression, and the purpose is specialized, such as longitude and latitude maps, regional alarm maps, etc. Thematic maps usually need to display the characteristics of the map theme by configuring related features, which can generally be classified into three types of points, lines, and polygons, and displayed in different with different icons and symbols. At the same time, it also generally supports related capabilities such as feature editing, frame configuration, drawing decoration and high-resolution output.

As thematic maps show a booming trend, the number of universal map browsing and viewing systems and software on electronic devices (computer monitors, mobile phones, tablets, in-vehicle screens, etc.) has also increased, and the workload involved in the task of making thematic maps has also increased. Meantime, different task situations require different cartographic methods, which will

further increase the error rate of cartographers, so a more efficient thematic map production method is needed.

In order to solve the above problems, this paper proposes the thematic map production method and software system in the domestic operating system environment, which can create a thematic map production space, establish a set of map symbols expressing elements, complete the production and output of thematic maps, with map frame and external decoration capabilities, and solve the problem that common map mapping tools cannot complete the adaptation and deployment of localization environments. At the same time, it complements the gaps in the traditional thematic map methods that cannot focus on elements on demand, and meets the display needs of users.

The structure of this paper is as follows: the second section introduces thematic map mapping method and mapping software system based on domestic operating system. The third section introduces examples. The fourth section mainly summarizes the content of this paper.

## 2. Thematic Map Output Process based on Domestic Operating System

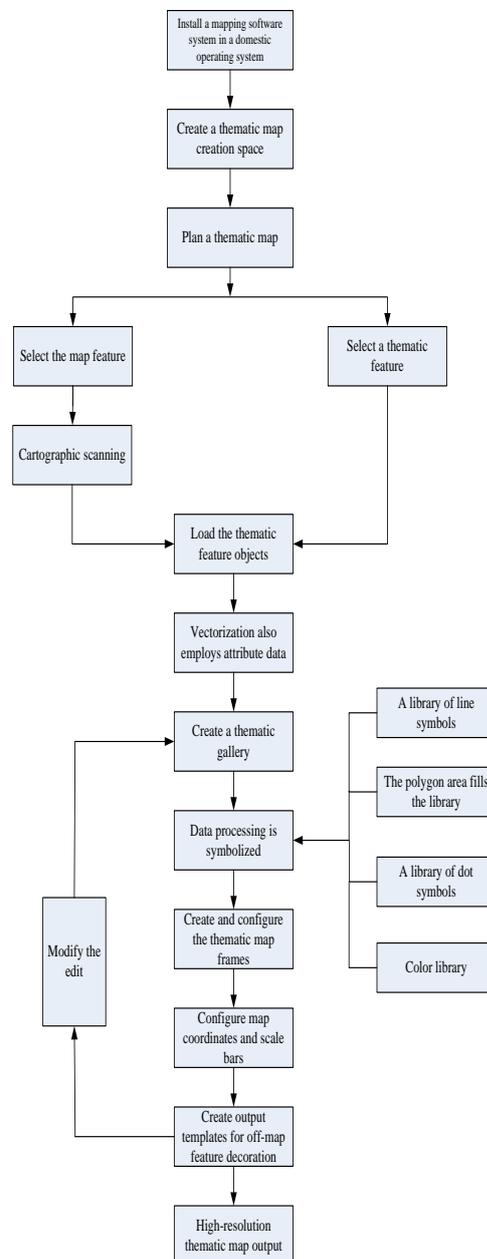


Figure 1. Schematic diagram of thematic mapping output process based on domestic operating system

This section mainly introduces the specific process of thematic map method in the domestic operating environment, as shown in Figure 1, the specific steps are below. First, install the drawing software system in the domestic operating system. Second, create a thematic map production space and load the map base map data. Then, establish a set of map symbols that express the features and load the thematic feature objects. Further, create and configure thematic map frames, configure map coordinate systems and scale bars and create an output template for off-map feature finishing. Finally, configure the output parameters to output a high-resolution thematic map.

### 2.1 Install the Drafting Software System in the Domestic Operating System

Install the thematic map mapping software in the domestic operating system, and open the software after the installation is complete.

### 2.2 Create a Thematic Map Creation Space

This step is to create a base map for the thematic map. According to the content of the topic, select the appropriate scale and spatial data to assist in expressing the features of the theme as the prime map. Base map data needs to be relevant to the topical content, including but not limited to vector data, image raster data, terrain shading, and so on. Then, preprocess the map as needed, including spatial data registration, projection transformation, cropping, masking and other operations.

### 2.3 Establish a Set of Map Symbols that Represent Features

Maps generally use abstract and common symbols to represent a certain class (level) of geographic things so that the reader can clearly understand the nature and distribution of features without additional textual descriptions. The detailed steps and the schematic diagram for establishing a feature map symbol set are as follows:

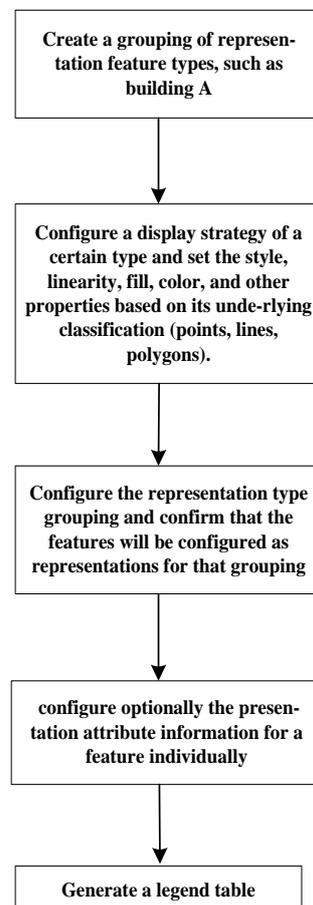


Figure 2. Establish a schematic representation of a feature map symbol set

- (1) Utilize the plotting tool to map.
- (2) Use the editing tool to select vector features in plotted features and layers, where the main types of features are points, lines, polygons, etc., and configure feature display symbols or policy attributes.
- (3) Take advantage of feature management tools to generate feature layers based on configuration strategies.
- (4) Edit feature layer properties to generate feature legend sets.
- (5) Save feature symbol sets.

### 2.4 Establish and Configure Thematic Map Frames, Map Coordinate Systems and Scale Bars

Unlike electronic maps, paper maps have clear page sizes, margins, obvious borders and definite scales, and in addition, the frame, name, legend, scale labeling, and payment need to be clearly stated. Specific steps include:

- (1) Use the Frame tool to create a map frame.
- (2) Configure the map projection coordinate system.
- (3) Allocate the map display scale bar.
- (4) Configure the frame style, including width, linetype, ruler, and so on; and configure the compass style.

### 2.5 Create an Output Template for Off-Map Feature Finishing

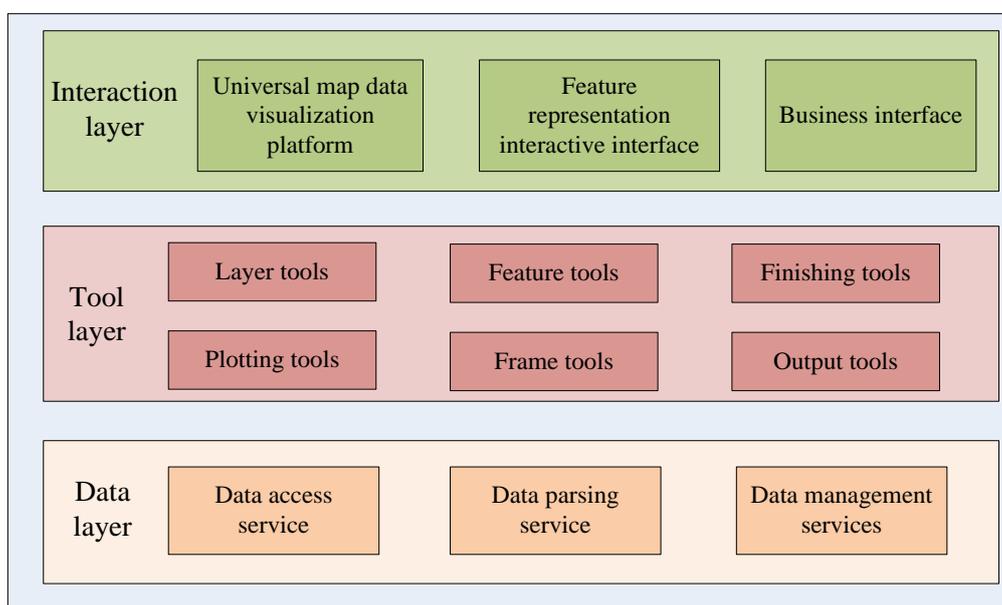
This paper has a complete operation function for the decoration of paper maps, and can form templates to facilitate the production of a series of unified and standardized paper maps.

### 2.6 Configure the Output Parameters to Output a High-resolution Thematic Map

Because it is displayed on an electronic screen, the resolution of the electronic map is generally not high. For the printout requirements of paper maps, this paper uses a separate map rendering process to ensure sufficient clarity on paper map pages.

## 3. Examples

Taking a port thematic map as an example, this paper describes the thematic map making method and software system of the domestic operating system proposed in this paper.



**Figure 3.** Functional block diagram of a drawing software system

Step 1: open the software.

Install the thematic mapping software in the domestic operating system, and open the software after installation.

Step 2: create the image layer, load the area map, configure the channel attributes, and configure the layer efficiency, brightness, transparency and other attributes.

Create TIFF format image layer in the software and load the map of a port area. Then, click the layer and configure the attributes such as channel, layer efficiency, brightness and transparency in the pop-up dialog box. The channel configuration belongs to the specific channel configuration of the software. The layer efficiency configuration is 2, the brightness configuration is 50%, and the transparency configuration is 10%.

Step 3: create vector layer, load City, district and coastal boundary data, and configure data display type and expression style.

Create a vector layer and load the coastal boundary data of a port, that is, connect the west of a port area and border an ocean. The corresponding target short side distance of the initial rectangle is 32.1km.

Step 4: create vector layer and port area data, configure linetype and set filling.

Create a vector layer, load the data of a port area, set the linearity to solid line, select blue in color ramp, and set other parameters to complete the filling of a port.

Step 5: create a special data layer and add AIS dataset, use the template of point to create the expression feature "ship". Then, configure its legend as the "ship" icon in the special font and the color is green.

Step 6: create a special data layer and add lighthouse data in excl format, use the point template to create the expression feature "Lighthouse". Then, configure the expression of the feature as the "light bulb" icon and the color is red.

Step 7: create a special data layer and add the route data in excl format, use the line template to create the expression element "route". Then configure the element expression as solid line, line thickness of 3 points and color of black.

Step 8: generate a feature representation legend set.

This step mainly generates the legend set of feature representation, including the legend set of point feature, line feature, color feature, representation symbol and other features. The element expression legend set is not only symbolic, artistic and expressive, but also easy to distinguish, read and remember.

Step 9: set the map projection coordinate system to WGS84.

The longitude and latitude projection meeting the requirements shall be selected as the projection method. Select the projection transformation in the data processing window, and then enter the data set projection transformation. First set the coordinate information of the source data. Then, set the map projection coordinate system to WGS84.

Step 10: set the map scale to 1:50000.

Since the short side distance of the target corresponding to the initial rectangle is 35.2km, and the drawing sheet is required to be 70cm. Therefore, the obtained target short side distance of 35.2km is divided by the target map to obtain the initial scale of 1:50286. Rounding the denominator 50125 of the obtained initial scale and the denominator of the nearest standard scale is 50000. Therefore, the mapping scale is determined to be 1:50000, and the scale is set in the software.

Step 11: plot the arrow and text content, and then set the font, size, color and other attributes.

This step is mainly for plotting. Draw the theme that needs to be reflected on the map with arrows and text. The arrow is set to yellow. The font is set to Song typeface. The font size is set to 12.5 points, and the color is set to black.

Step 12: set the frame range and style, and set the coordinate grid and north arrow style.

Set the size and style of the frame. The width is set as 70mm and the line type is set as solid line. Select the properties command on the upper right of the layer, and then hit grids in the open dialog box. After entering the tab, select news grids to configure the coordinate network. Set the longitude and latitude display font to Song typeface and the font size to 10.5 points; Click the north arrow legend to open the north arrow Properties dialog box, and select the style of the north arrow in the dialog box.

Step 13: open the drawing finishing tool window and load the block diagram data.

Step 14: add thematic map title, drawing time and scale, and then configure its location and font.

Open the properties dialog box, modify the title of the thematic map in the dialog box, set the font to Song typeface and the size to 16 points. Right-click the scale bar legend to open the Speed Scale Line Properties window, then click the Format tab to select a scale bar style. When the properties of the scale bar are determined, the size and position of the scale bar can be done directly by stretching and moving in the layout view.

Step 15: Add a legend and an eagle eye diagram.

Switch the map view to layout view via the View menu and click Insert -- Legend to finish adding the legend. Right-click Legend to open the Properties dialog box, then select the format in which the legend is displayed in the dialog box and click the Legend tab to set Title to "Legend". At the same time, the features are renamed in Layers. the font is set to Song font and the font size is 10.5 points to complete the name labeling of the legend. Similar to the steps above, click Insert - Eagle View in Layout view to finish adding the Eagle Eye diagram.

Step 16: Configure output resolution.

Open the Output Map dialog box below the file. Then, set the format to jpg and the resolution to the resolution you want.

Step 17: Export the featured map and save it.

## 4. Conclusion

A thematic map mapping method and mapping software system based on domestic operating system are proposed in this paper. Through the detailed steps, high-resolution thematic maps can be output, which solves the problem that common map mapping tools cannot complete the adaptation and deployment of localization environments, fills in the blanks that paper cannot be customized on demand, and lays a new foundation for the development of thematic maps.

## References

- [1] Chen S, Wang W, Liang H. Evaluating the effectiveness of fusing remote sensing images with significantly different spatial resolutions for thematic map production[J]. *Physics and Chemistry of the Earth, Parts A/B/C*, 2019, 110: 71-80.
- [2] Freeman L, Sullivan C. Thematic analysis[J]. *Doing qualitative research in psychology: A practical guide*, 2019: 161-184.
- [3] Wang P, Wang L, Wu Y, et al. Utilizing pansharpening technique to produce sub-pixel resolution thematic map from coarse remote sensing image[J]. *Remote Sensing*, 2018, 10(6): 884.