COMPARISON BETWEEN SEVERAL SOFTWARES WITH THE FUNCTION OF GENERATING RELIEF SHADING

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ABSTRACT：

Relief shading maps have become a popular and useful means for representing topography in a natural, aesthetic, and intuitive way. In this paper, a comparison among the applications in producing relief shading maps using ArcGIS, Photoshop, and MapWindow software is given. First, brief introductions to each application are given. Then, the color model differences, as well as some relief shading images and the evaluation of them are shown. The digital elevation model (DEM) used is SRTM with 90m resolution for Tianshan region in Xinjiang district, China. The specific range is 40°N to 45°N latitude and 80°E to 85°E longitude. This DEM has a good variety of terrain surfaces and range in elevation.

1. INTRODUCTION

Relief shading is a method for representing topography on maps in a natural, aesthetic, and intuitive way. It shows the ups and downs of the land portrayed on a map. The process makes land look three-dimensional by the use of graded shadow effects. The light direction is very important for the design of a shaded relief. Normally the cartographer lets the light "shine" on the terrain from the upper-left. Less popular is illumination from south, as the relief shading tends to not "look right" [1].

With the development of computer technology and the improvement of algorithm for generating DEM, more and more software for analytical relief shading are available. There are not only the professional GIS applications, but also non-GIS applications such as Adobe Photoshop.

In this paper, three applications in creating relief shading are introduced, ArcGIS, Photoshop, and MapWindow, the comparison among them is given.

2. RELIEF SHADING IN ARCGIS[2,3]

ArcGIS Desktop includes a suite of integrated applications that allow the users to perform GIS tasks, from simple to advanced. In this paper, the 3D analyst model in ArcMap is used.

With the ArcGIS 3D Analyst toolbar, a shaded relief map from an elevation raster could be created using the Hillshade tool. The default azimuth and altitude values work well for graphical display. Azimuth is the angular direction of the illumination source, the default angle of 315 degrees is northwest. Altitude is the slope or angle of the illumination source above the horizon. The default is 45 degrees above the surface (see Figure 1).
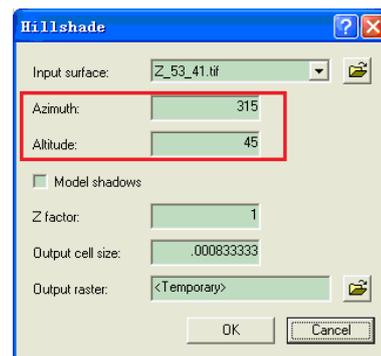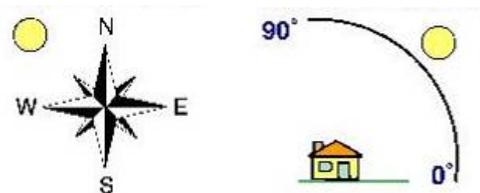

Figure 1 (a). The Hillshade tool

Figure 1 (b). Sketch for the azimuth and altitude (get from the ArcGIS Desktop help documentation)

3. RELIEF SHADING IN PHOTOSHOP[4]

Adobe Photoshop is the graphic arts industry standard software for raster image manipulation. Cartographers can also use Photoshop to create effective colored relief shading maps. Photoshop is an extremely powerful image-editing tool and a skilled cartographer can make many enhancements to a shaded relief map image once it is rendered.

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In this paper, the Adobe Photoshop CS version is used. A grayscale to height image is needed to create relief in Photoshop. The SRTM is used here.

Coloring physical terrain by elevation is known as hypsometric tinting. It is an effective way to portray terrain when combined with shaded relief. In this paper, these two techniques in Photoshop are combined and a grayscale relief shading map is produced.

To create a relief shading map in Photoshop, it is important to create and arrange the layers. When tweaking adjustment layers, colors, etc, be sure that the layer and mask worked on are active. Photoshop is a mighty engine if you know how to control it. Turn layers on and off to check the results and keep tweaking. The most important layer to create the relief effect is an alpha channel. It must be used as the texture channel (see Figure 2). In the left of the Light Effects tool the light direction can be adjusted to get the best relief effect.
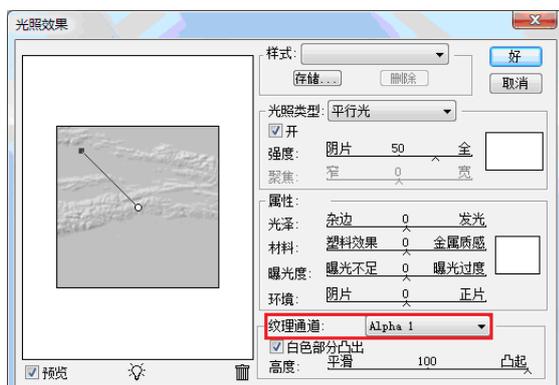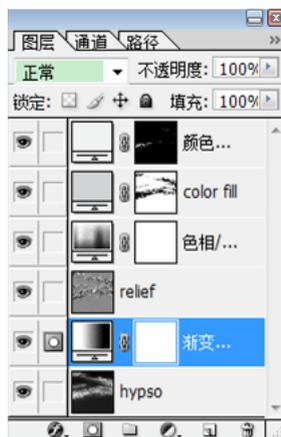

Figure 2. Light effects in Photoshop

Figure 3. Layers used in creating relief shading

Use Photoshop filters to enhance relief because it will look a bit stair-stepped and rough when you first render it. The Blur/Gaussian blur, Noise/Median filter, and Sharpen/USM sharpen filter are used in this paper.

4. RELIEF SHADING IN MAPWINDOW GIS

The MapWindow application is a free, extensible, open-source geographic information system. It can be used in many ways [5]: as an open-source alternative desktop GIS, to distribute data to others, to develop and distribute custom spatial data analysis

tools and so on. In this paper, the function of data view and the Coloring Scheme Editor tool are used.

The Coloring Scheme Editor is used to change the coloring scheme and other arguments. The coloring scheme styles can be customized. The Coloring Scheme Editor allows you to automatically populate the coloring scheme from a predefined coloring scheme. There are four choices can be chosen from: Continuous Ramp, Equal Breaks, Unique Values, or Pre-defined. There are also several hillshade computation methods you can choose from (see Figure 4).
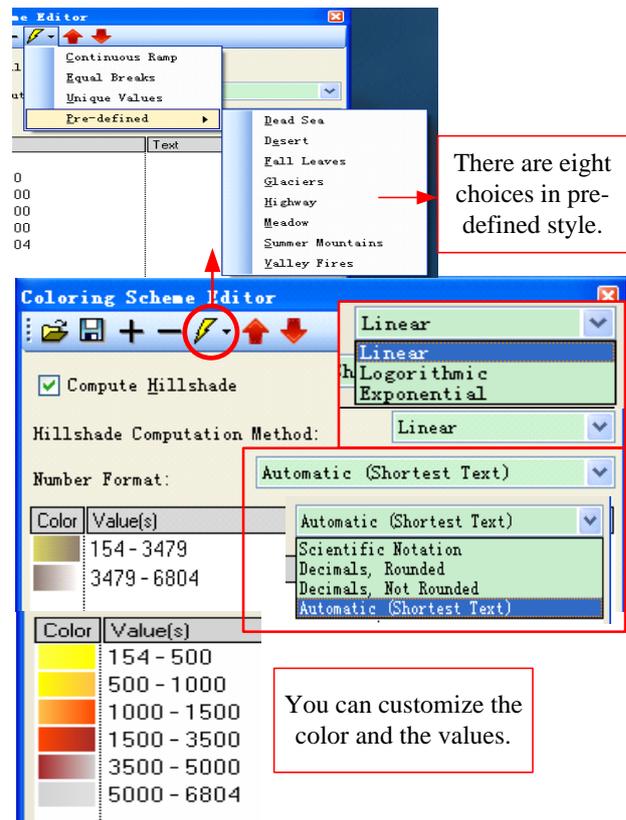

Figure 4. The Coloring Scheme Editor and what you can do with it

Figure 5. An example of 'deadsea' color style in pre-defined

5. COMPARISON

Please take your attention for that the range of the figures given

in this part is changed for the space limited. About one quarter of the test region is shown.

Two parts are included in this section, the comparison with color models used in each application and the comparison with the relief shading images created from the applications.

5.1 Different Color Models Used in Each Application

For ArcGIS, there are three sliders in Color Selector, RGB, CMYK and HSV, one can be seen at one time.

For Photoshop, there are four, RGB, CMYK, HSB and Lab, and they are on the same palette. It's easy to see the changes in different styles all at once.

For MapWindow, there are two, RGB and ESL (HSB) at one palette.

Different color models are used in the applications. And there is a little difference in converting between different color spaces in different applications.

Though they all have RGB color model, it is equipment-related. The color used may look different when it is shown in another monitor. In this paper, the grayscale is chosen in comparing between the relief shading effects below.

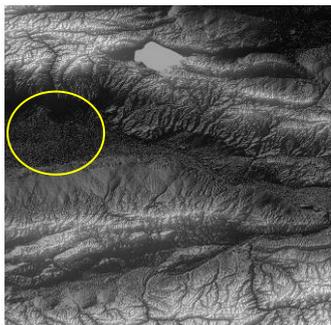## 5.2 Comparison with Relief Shading Images

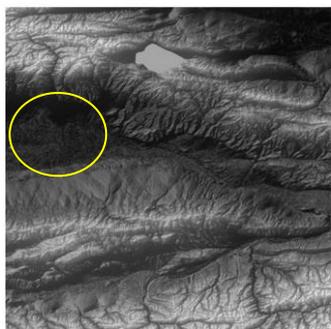Figure 6(a). Relief shading created in ArcGIS

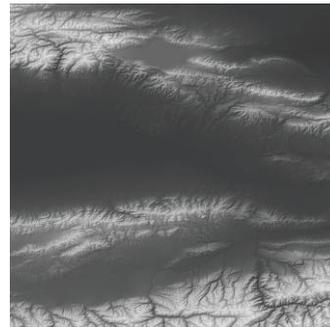Figure 6(a-1). Relief shading created in ArcGIS adjusted in Photoshop

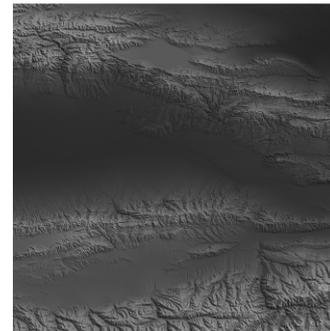Figure 6(b). Relief shading created in Photoshop

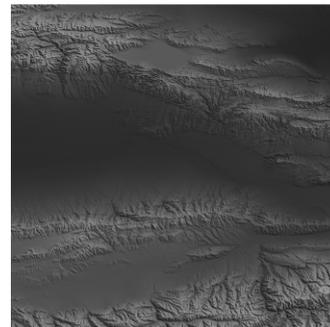Figure 6(c). Relief shading created in MapWindow

Figure 6(c-1). Relief shading created in MapWindow adjusted in Photoshop

The relief shading created automatically in ArcMap (see Figure 6(a)) usually has too many details (see inside the yellow ellipse) that may be somewhat undesirable. The enhancements with Photoshop can bring more perfect ones (see Figure 6(a-1)).

The relief shading created in Photoshop gives less detail, but the whole effect looks fine and smooth. One can conceive the main landforms easily (see Figure 6(b)).

The relief shading created in MapWindow gives less detail than the one from ArcGIS, but more than the maps produced using Photoshop. After the adjustment with filters in Photoshop, one can get more perfect relief shading (Figure 6(c) (c-1)).

As said at the beginning, the light direction is an important factor to create relief shading images. The azimuth and altitude could be set in ArcGIS, and the light source could be adjusted in Photoshop. But they cannot be adjusted in MapWindow.

6. CONCLUSIONS

Generally speaking, for producing relief shading map, any one of the application reviewed in this paper can be adequate.

But the relief shading image generated from GIS software (such as ArcGIS, MapWindow) requires some touch-up and adjustment in Photoshop to get more desired one.

Except for the factors affect the quality of the relief shading in the software itself, other factors include DEM quality and resolution, graphic eye and experience of the cartographer could also contribute to the relief shading quality.

REFERENCES

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[2] ArcGIS Desktop help documentation.

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[4] http://www.mapwindow.org/ (accessed 2009/7/20)