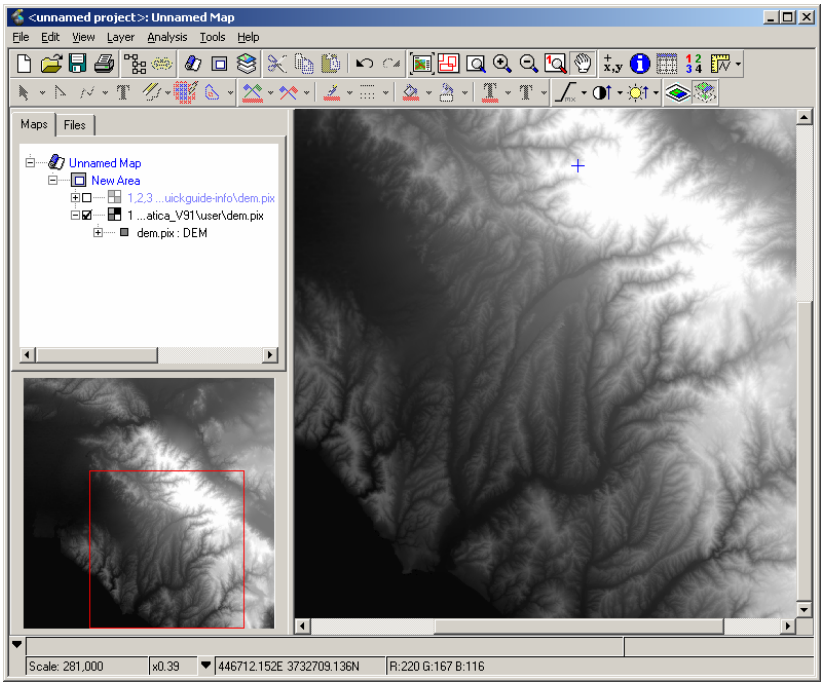
Creating a Color Shaded Relief Model

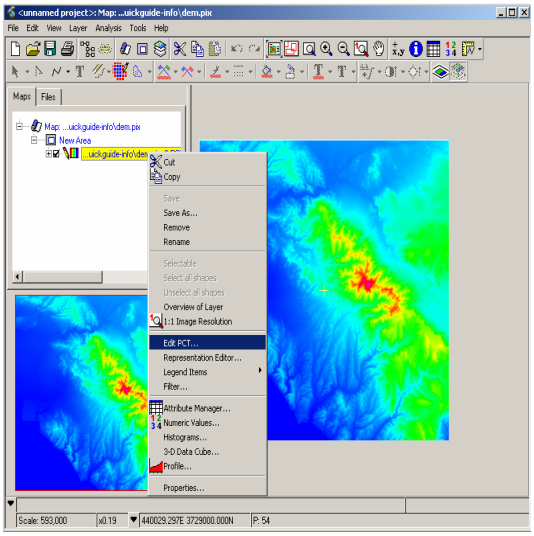
Shaded relief models indicate terrain displacements using a shadow effect from evaluating the aspect and slope relative to the sun's azimuth angle and altitude achieved with varying grey scale tones resulting in the darkening of one side of terrain features, such as hills and ridges (the darker the shading, the steeper the slope). The shadow direction is affected by the sun's azimuth setting and shadow length is affected by the altitude component. The models provide subtle shadings which we naturally perceive as depth, helping to make the image look three dimensional. A drawback with this type of model is that depending on the placement of the illumination source, the eye and brain often see different things. Adding color to the shaded relief images helps to portray elevation using both a color ramp and the shading effect. Color shaded relief models are usually graded from cooler (darker) colors representing lower elevations to warmer (brighter) colors depicting greater elevations.

You will notice when loading shaded relief models with a pseudo color table (PCT) that it will be given a general default color ramp that most often does not represent your DEM very well (especially along coastal areas). To obtain best results it is recommended that you manually edit your PCT.



Step1 (Scale DEM):

- Load DEM into Focus
- Scale the DEM down to an 8 bit DEM with the **SCALE** command



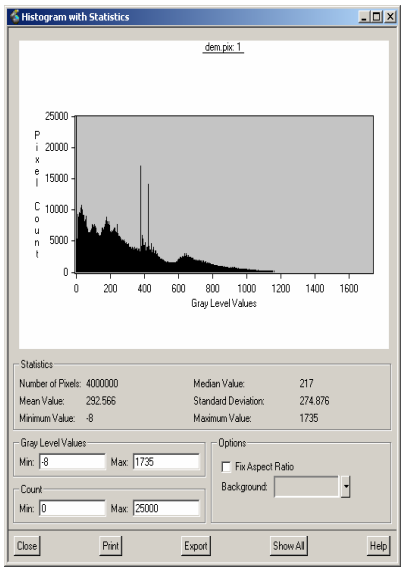
Step2 (Load DEM):

- Load DEM as pseudo colored layer with the Add Layer Wizard in Focus

A common problem when working with CSR models is that most people first assume that blue color represents water so when blue colors are used for landward features they can often be somewhat misleading. So before you begin editing your PCT you may wish to calculate the best place to separate the blue colors from the other colors so that you do not have any features on land that people will assume is water.

By calculating the slope of the line thru your minimum and maximum DN values of your DEM using the formula of a straight line, then you can determine where the cut off value should be.

$$y = mx + b$$

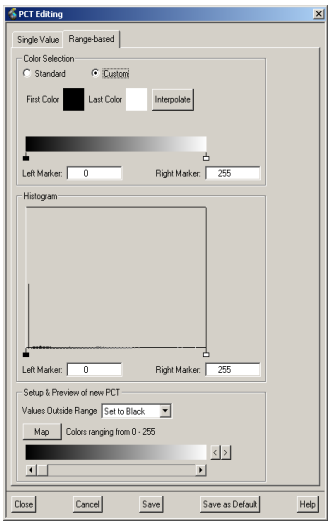


To solve the equation you will need to calculate the values of the constants *b* (y intercept) and *m* (slope), that can easily be calculated from any two know points. Since you know the minimum and maximum DN values (from your histogram) of the DEM, you can begin by deriving the slope using the following two points (min value, 0) and (255, max value).

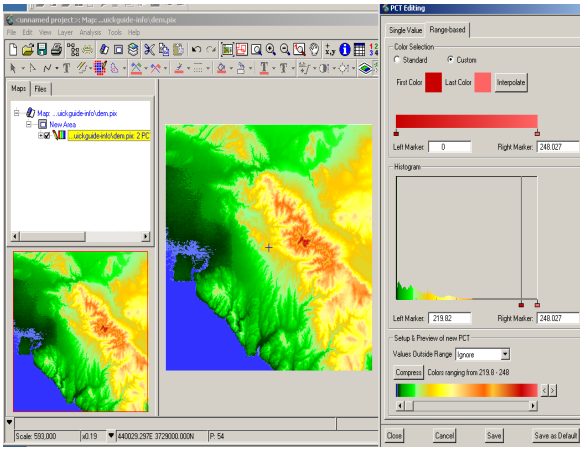
$$slope = \frac{y_1 - y_2}{x_1 - x_2}$$

After you have determined the slope you can then enter the value back into the equation and solve for *b* (y-intercept). Calculating the value of *b* will allow you to determine the value of *y* when *x* = 0, or the actual place where water and land should meet (assuming your DEM contains orthometric heights).

Step3 (Edit the PCT):

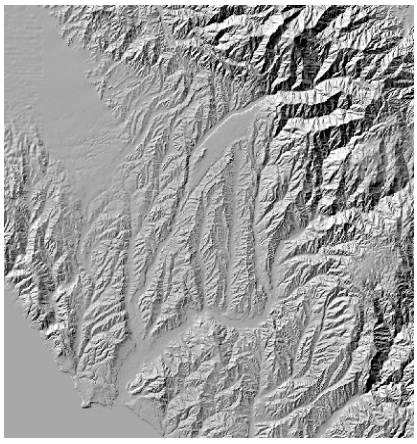


- Right click on your scaled DEM in the Maps tree, select **Edit PCT** to open the PCT editing window.
- Select the **Gray Ramp** button to change the colors back to gray scale and then switch to the **Range Based** tab and click the **Custom** radio button.
- Set the first color (e.g. black) and the last color (e.g. blue), then press **Interpolate**.
- In the **Histogram** window set the values for the left and right markers that you want to map this color range to and press the **Map** button (the first time you do this, you will want to have the **Values Outside Range** set to black, but every other time you repeat this, you will want this option set to ignore).
- Repeat the above steps until all values in your image from 0 to 255 have been mapped using colors blues, greens, yellows, oranges and then reds (with blue and green representing low elevations and orange and reds representing high elevations)
- When you are finished **Save the PCT** as a segment to your DEM file.



Step4 (Shaded Relief):

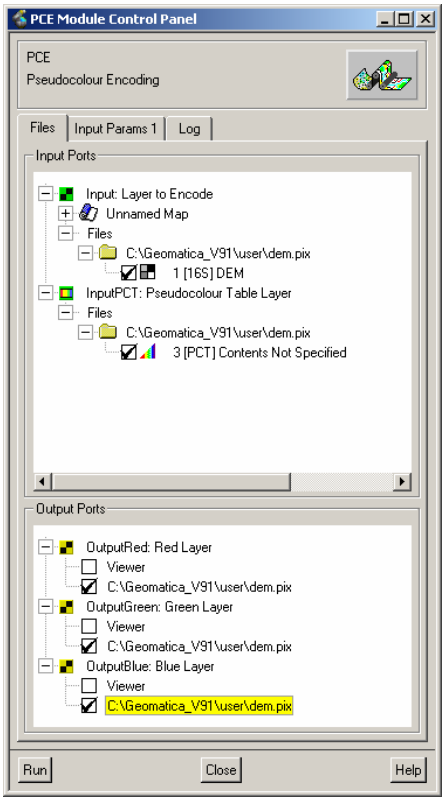
When you generate the shaded relief be sure to use the original DEM data and not the scaled DEM (Optional, If your area has relative low relief you may want to exaggerate the relief, to emphasis topographic features in your DEM)



- In Focus open **REL** from the Algorithm Librarian
- Right click on the **Output File**, select **Browse** and then select your input DEM file as the output file source (this will add the result of the REL module as a new channel of your pix file)
- Specify the light source (Azimuth and elevation angles)
- Specify an elevation step size factor if you wish to exaggerate the relief
- Run the **REL** module

Step5 (Generate RGB image):

- In Focus open **PCE** from the Algorithm Librarian
- Select the **PCT file** and **input DEM** to encode
- Right click on the **Output File**, select **Browse** and then select your input DEM file as the output file source (this will add the result of the REL module as a new channel of your pix file)
- Run the **PCE** module

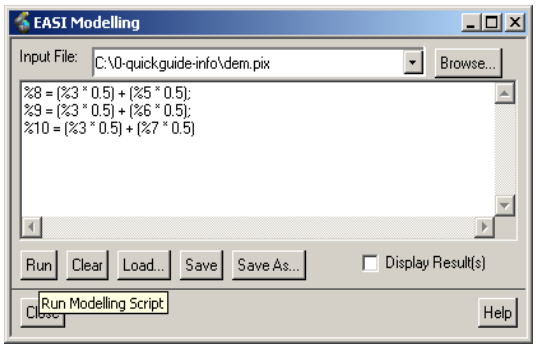


Step6 (Model the CSR):

- In Focus **Add** three 8 bit channels to your file
- Open the **EASI Modeling** Modeler window
- Add the following EASI script

```
%17 = (%4 * 0.5) + (%5 * 0.5);
%18 = (%4 * 0.5) + (%6 * 0.5);
%19 = (%4 * 0.5) + (%7 * 0.5)
```

- **Run** the Modeling Script



Load your new CSR image into Focus to examine your results.
(Optional, you may want to export the resultant CSR channels from your working DEM pix file into a separate image when you are finished)