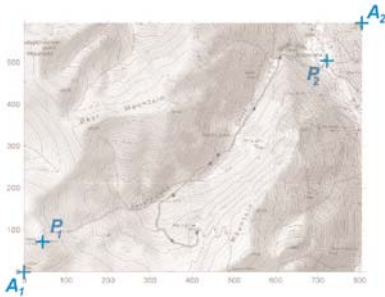




Calibrating Bitmap Corners from Points Within the Map in Surfer 7

When using an image as a base map in Surfer, the bitmap is not referenced in real world (or map) coordinates, but referenced in pixel coordinates. You can calibrate the image in map coordinates if you know the coordinates of the lower left and upper right corners of the image. Often, the coordinates of these corner points are unknown. If you know the map coordinates of two points anywhere on the image, you can calculate the map coordinates of the corner points. You can use the calculated values to reference your image.



Base map of St. John, Colorado in pixel units. Two points with known map coordinates are labeled P1 and P2. The corner points are labeled A1 and A2.

Consider the map above. Points P1 and P2 have known map coordinates of (m1, n1) and (m2, n2), respectively. These two coordinate points can be used to mathematically determine the map coordinates of the corner points A1 (mmin, nmin) and A2 (mmax, nmax) using the following equations:

$$m_{min} = m_1 - (x_1 - x_{min}) \cdot \frac{(m_2 - m_1)}{(x_2 - x_1)}$$

$$n_{min} = n_1 - (y_1 - y_{min}) \cdot \frac{(n_2 - n_1)}{(y_2 - y_1)}$$

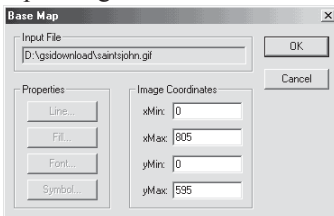
$$m_{max} = m_2 + (x_{max} - x_2) \cdot \frac{(m_2 - m_1)}{(x_2 - x_1)}$$

$$n_{max} = n_2 + (y_{max} - y_2) \cdot \frac{(n_2 - n_1)}{(y_2 - y_1)}$$

where:

- (m1, n1) and (m2, n2) = map coordinates of P1 and P2.
- (mmin, nmin) and (mmax, nmax) = map coordinates of A1 and A2.
- (x1, y1) and (x2, y2) = pixel coordinates of P1 and P2.
- (xmin, ymin) and (xmax, ymax) = pixel coordinates of A1 and A2.

The map coordinates of P1 and P2 are known to be (-105.91058, 39.55910) and (-105.86758, 39.58019), respectively. You can determine the pixel coordinates of A1 (xmin,ymin) and A2 (xmax,ymax) by double clicking on the map. The pixel coordinates are displayed in the Base Map dialog box.



The pixel coordinates (xmin, ymin), (xmax, ymax) of the image corners are displayed in the Base Map dialog box.

The pixel coordinates of P1 and P2 are determined by digitizing these two points. You digitize the points by selecting the map and choosing the Map | Digitize command. The cursor will turn into a cross hair. Move the cross hair to the center of P1 and click the left button on the mouse. Once you click on the map, a window labeled digit.blm opens and stores the coordinates of P1. Repeat these steps for P2.



The pixel coordinates of P1 (x1, y1) and P2 (x2, y2) are displayed in the digit.blm window.

Insert these values into the equations above:

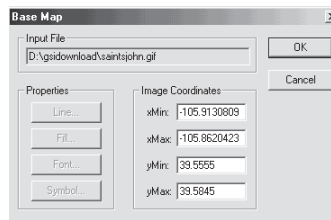
$$m_{min} = -105.91058 - ((43.738 - 0) \cdot \frac{-105.86758 - (-105.91058)}{721.548 - 43.738}) = -105.91335$$

$$n_{min} = 39.55910 - ((71.5633 - 0) \cdot \frac{39.58019 - 39.55910}{503.84833 - 71.56333}) = 39.55561$$

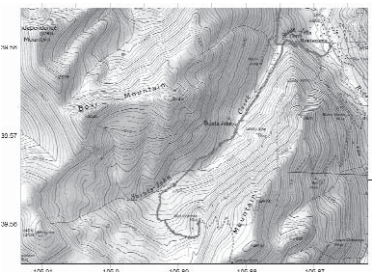
$$m_{max} = -105.86758 + ((805 - 721.5483) \cdot \frac{-105.86758 - (-105.91058)}{721.548 - 43.738}) = -105.8623$$

$$n_{max} = 39.55910 + ((595 - 503.848) \cdot \frac{39.58019 - 39.55910}{503.84833 - 71.56333}) = 39.58463$$

Once the map coordinates are determined for the corners of the image using the equations above, double click on the map to open the Base Map dialog box. Replace the pixel coordinates with the correct map coordinates. The coordinates may require minor adjustment to correct for the relatively low screen resolution. The resulting map is displayed below.



Enter the calculated map coordinates in the Base Map dialog box.



St. John base map displayed with map coordinates (latitude / longitude degrees).