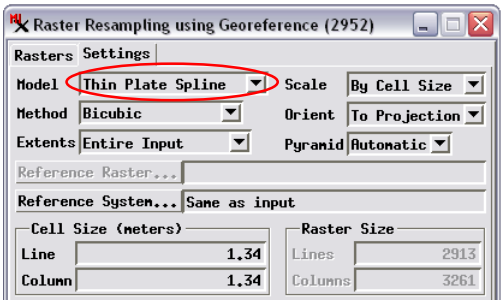
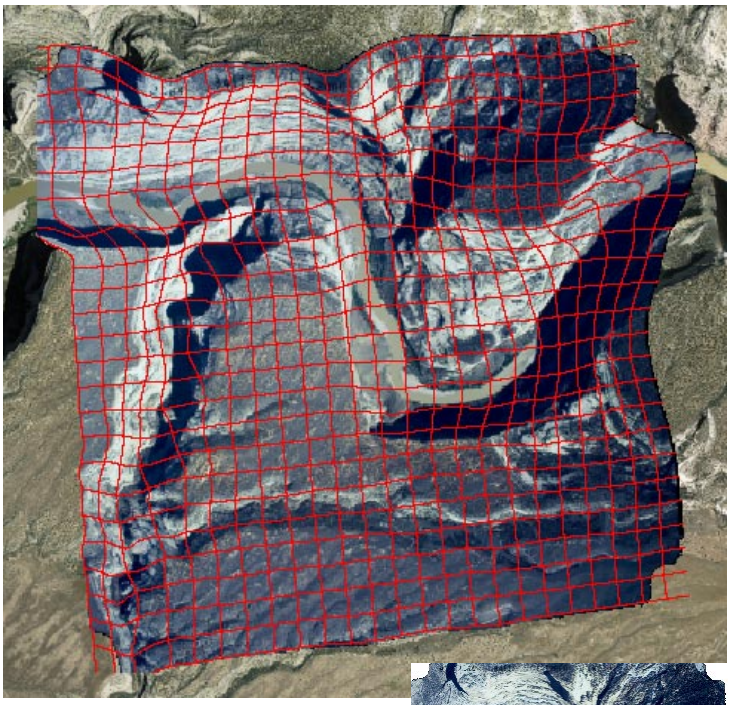
Reproject Using Thin Plate Spline Model

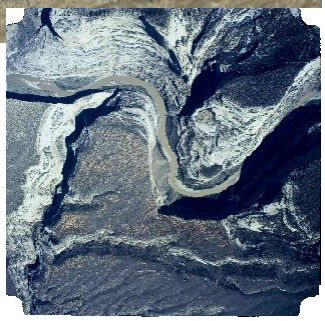
The Raster Resampling using Georeference process in TNTmips (Image / Resample and Reproject / Automatic) offers a choice of mathematical models to perform the coordinate transformation to the designated coordinate reference system. The Model menu on the Settings tabbed panel of the process window offers several global best-fit models (including affine, conformal, plane projective, and polynomial models of various orders) in which the map coordinates of control point locations may be adjusted to varying degrees to achieve the best global fit. The piecewise affine model maintains the assigned map coordinates of all control points but computes a unique affine transformation for each triangular patch of the raster between control points.

The Thin Plate Spline model is a global elastic transformation that maintains the assigned map coordinates of all control point locations but applies smoothly varying transformations between control points. Using the input control points, the transformation from image to map coordinates is modeled mathematically as the deformation of a thin elastic plate. The computed global transformation minimizes the bending energy (curvature) of this hypothetical plate. The influence of an individual control point in this model is localized and diminishes rapidly with distance from the point.

Use the Model menu on the Settings tabbed panel to choose the transformation model to use when resampling and reprojecting the input raster(s).



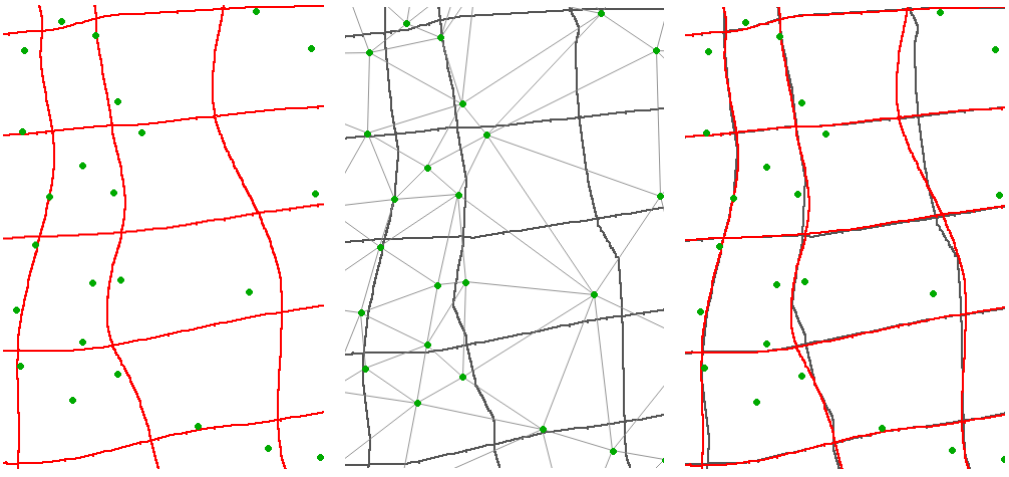




Right, unrectified color aerial photo of an area about 3 km wide featuring a deep canyon (over 300 m local relief) in northwest Colorado, USA. Above, the photo raster after georeferencing (with over 450 control points) and reprojection using the Thin Plate Spline model. The photo is overlaid on an orthoimage of the area. The red lines superimposed on the photo show the resampling result for a set of originally orthogonal grid lines matching the extent of the photo. These lines emphasize the varying changes in geometry of the photo resulting from the reprojection.

Because the Thin Plate Spline method does not adjust the assigned map coordinates of the input control points during the reprojection, the result is sensitive to any errors in placement of the control points. In addition, the control points should be well-distributed over the input image, including points near the edges. You may wish to check the result of the reprojection with an independent set of ground control points if available.

The Thin Plate Spline model is not available as a warping model in the Georeference process because the transformation between image and map coordinates is not mathematically reversible.



Thin Plate Spline Model **Piecewise Affine Model** **Comparison**

Details of lines resulting from reprojecting an originally orthogonal square grid using the Thin Plate Spline and Piecewise Affine models for a local area of the image illustrated at the top of the page. Green dots are georeference control points. The Thin Plate Spline model produces a smoothly varying transformation illustrated by the curving grid lines, whereas the Piecewise Affine model utilizes a unique affine transformation for each triangular patch between control points.