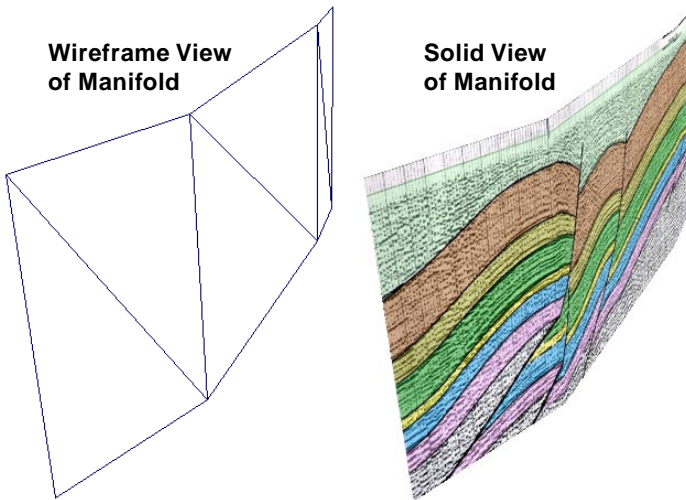
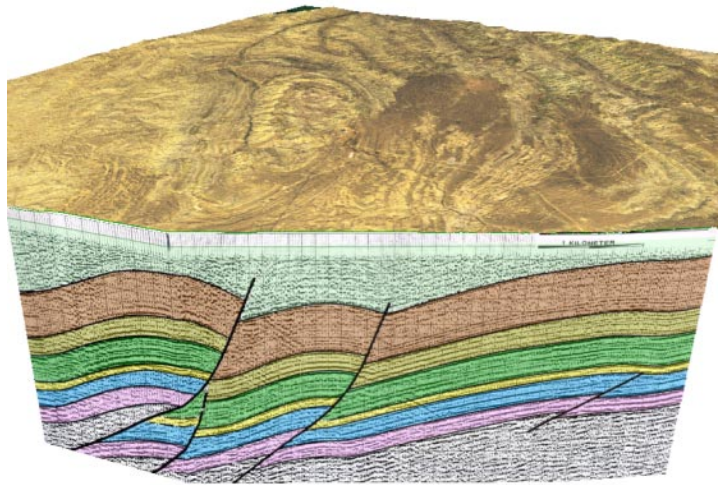


Manifolds in 3D Views



A raster manifold showing a vertical seismic reflection profile acquired along a curving transect line. Displayed by itself in wireframe view (far left, showing the triangular mesh created from the control points) and solid view (center). Displayed at

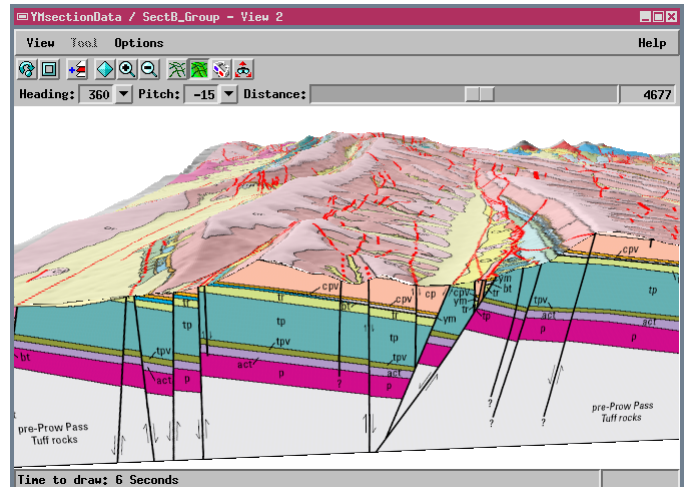
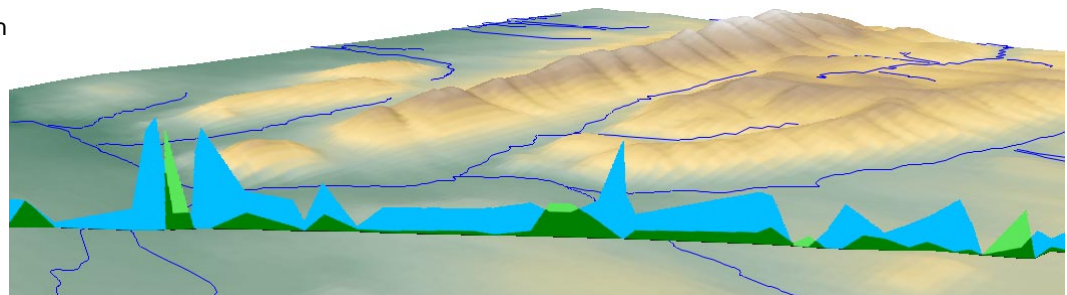


right in combination with an elevation surface and a satellite image as a drape. The drape raster is displayed with a mask to render the area in front of the section line transparent so that the subsurface manifold is visible from this view direction.

3D perspective views in the TNTmips Display process typically include a *surface raster*, whose cell values define the elevation variations of a surface, and one or more geospatial objects as *drapes*, which are projected onto that surface. Perspective views can also include *manifolds*: TNT raster or vector objects projected onto vertical planes, curving vertical curtains, and more general 3D shapes within the scene. A manifold contains its own shape and position information in the form of a set of 3D georeference control points. These control points define a 3D triangular mesh representing the manifold surface onto which the object is projected. A manifold can be viewed by itself in a perspective view, or in combination with a conventional surface raster and its drape(s).

Various examples of manifolds in 3D perspective views are illustrated on both sides of this page. The simplest and most obvious application of manifolds is the display of cross-sections showing the vertical distribution of some property along a transect line. For example, cross-sections showing the distribution of subsurface materials or their geophysical properties are widely used in the fields of geology, geophysics, mineral and petroleum exploration, engineering, and archeology. Cross-sections can also be used to show vertical variations in ocean or atmosphere properties. You can also use a manifold to show a graph of some measured property along a transect in the perspective view; examples might include the proportions of different vegetation types or the concentrations of chemicals or other pollutants in the soil, air, or water.

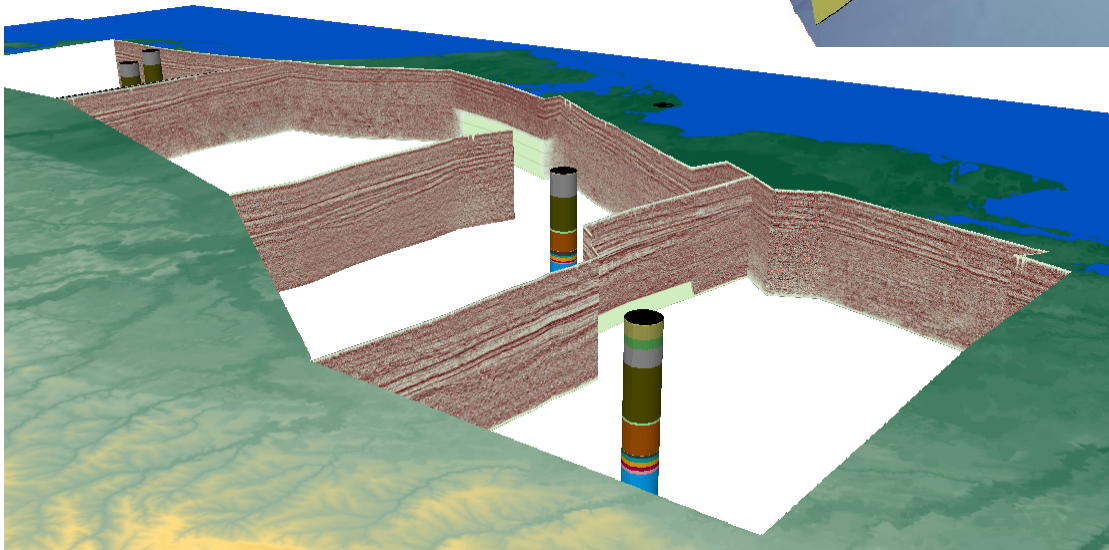
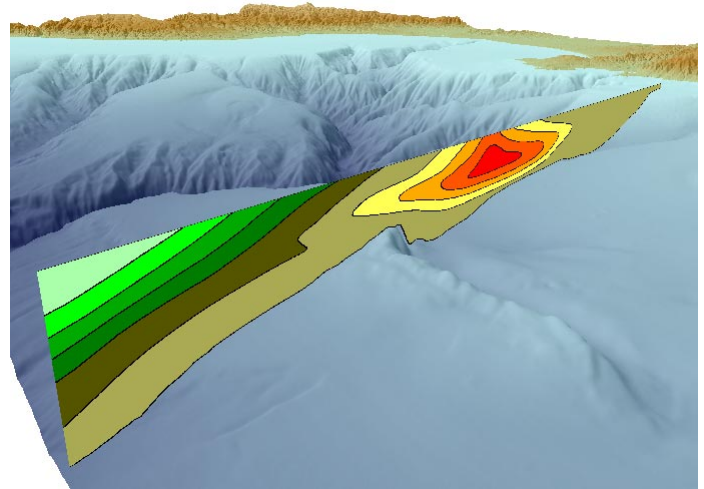
A raster manifold showing a graph of percentages of evergreen shrubs (green) and deciduous shrubs (blue) in the vegetation cover along a transect line in northern Alaska. The highest blue peak reaches 100%. The transparent part of the manifold has a single cell value set to be the null value for the raster.



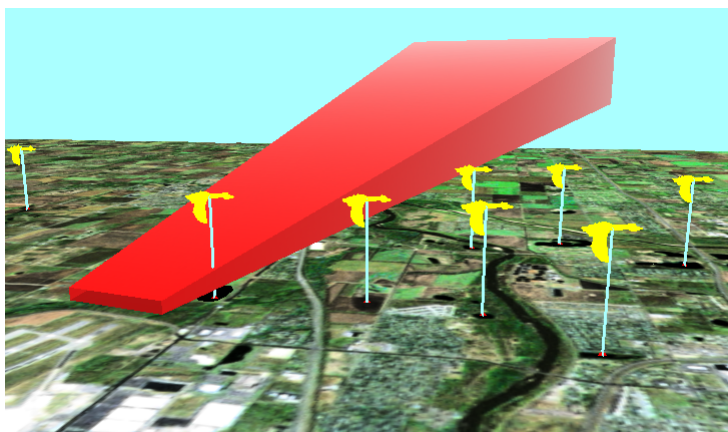
A raster manifold showing a vertical geologic cross-section (foreground). Behind the manifold is an elevation surface draped with a raster image of a hill-shaded geologic map.

You can set up a vector or raster object to display as a manifold in the Georeference process by assigning 3D control points using the 3D Piecewise Affine model. Objects with this special manifold georeference are displayed only in perspective views; the only 2D view windows that can display manifolds are those in the Georeference process and Spatial Data Editor, which display a “flat” view of the manifold object to allow editing operations.

The vector manifold in the illustration to the right represents a vertical cross-section from the ocean surface to the ocean floor south of Monterey Bay, California. The manifold is perpendicular to the coast and shows hypothetical velocity contours for coast-parallel offshore currents. The light green color represents maximum southeastward velocity, while red represents maximum northwestward velocity. The zero-velocity contour is the boundary between green and brown colors. The surface raster displayed with the manifold incorporates both bathymetry and land topography and is draped by a raster image of a color-shaded relief view of the surface. Monterey Submarine Canyon is visible immediately behind the manifold.

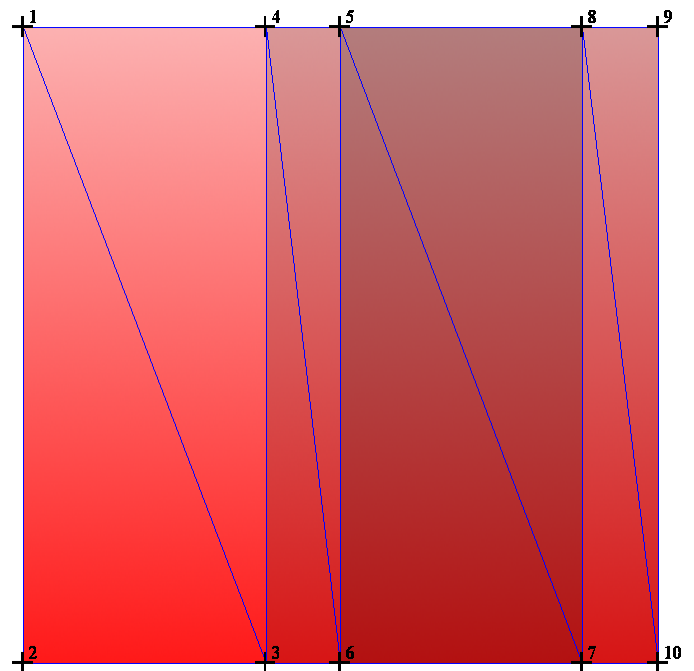


This view of data from the north coast of Alaska combines four raster manifold seismic reflection profiles with solid (extruded) circular polygons showing subsurface rock units (via color stack styling) encountered in exploratory wells in the region. Manifolds and wells are visible through a transparency mask used with the surface elevation drape.



The control points defining a manifold surface can create a closed or partially-closed shape that can be used to represent a volume in a 3D view. The wedge-shaped raster manifold in this illustration is meant to indicate the volume encompassing lines of aircraft approach and takeoff for an airport. The color gradients and shadings representing the different sides of the manifold were designed to accentuate the 3D effect. This raster was created as a TIFF file in a graphics software program and then georeferenced and displayed in TNTmips; the illustration at the right shows the raster in 2D view in the Georeference process with its control points and resulting triangulation.

This view also includes extruded points meant to show hypothetical locations of ponds frequented by flocks of waterfowl whose



flights pose a significant hazard to aircraft near the airport. Note that the relative foreground-background positions of the point symbols, stalks, manifold, and surface drape are correctly resolved on a pixel-by-pixel basis in the perspective view.