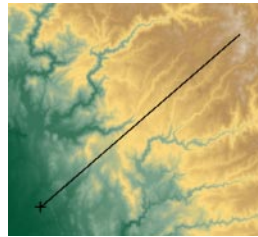# Analyze Raster and Web Terrain Profiles

The Profile View window provides a number of display modes and tools to let you analyze and view statistics of profile plots you create from rasters or terrain surfaces in TNT views (see the Technical Guide entitled *GeoToolbox: View Raster and Web Terrain Profiles*).
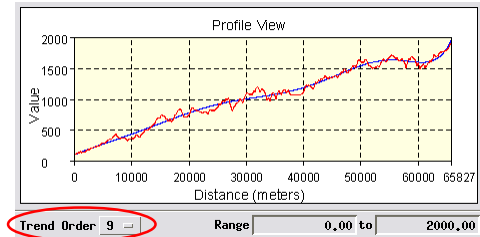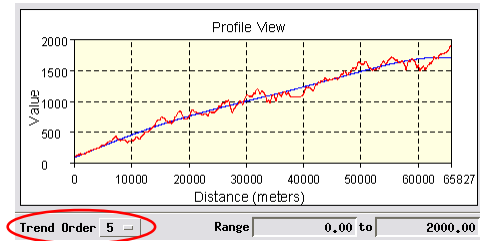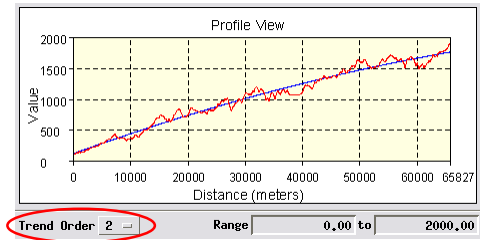
Trend Lines

Turning on the Trend toggle option on the Show menu adds a polynomial regression trend line to the profile plot. You can vary the order (maximum exponent value) of the polynomial expression from 1 (linear) to 15 using the Trend Order menu below the profile plot. The higher the polynomial order, the more closely the trend line conforms to the profile. Examples using a topographic profile are illustrated to the right.

Left-clicking on the profile plot places a set of cross-hairs that you can move across the plot. The vertical reference line of the cross-hairs indicates the current horizontal position along the profile, and various measures for this location are shown in the numeric fields at the bottom of the Profile View window. The Value field shows the profile line value at the current location while the Distance field shows the horizontal distance from the profile origin. The Trend Value field shows the value of the trend line of the current order at the current distance (whether the trend line is displayed or not), while the Trend Residual shows the difference between the profile and trend values. The semivariance and autocorrelation values are statistical measures of the relatedness of adjacent values along the profile.


The Trend toggle option on the Profile View's Show menu adds a polynomial regression trend line (blue) to the profile plot. Select the mathematical order (1 to 15) of the polynomial expression from the Trend Order menu. The illustrations above show trend lines of various orders fit to a topographic profile from the USA NED10 web terrain tileset sampling the western slope of a mountain range in California. A left mouse-click on the plot area places a set of crosshairs as shown in the bottom left illustration. The numeric fields in the panel at the bottom of the window show values of various statistics at the current location along the profile as shown by the vertical reference line of the cross-hairs.

Analysis Plots

Options on the Analysis menu allow you to show how several types of derived values vary along the profile. These values include the slope (First Derivative), change in slope (Second Derivative), Trend Residuals, and the Semivariance and Autocorrelation statistics. Examples are illustrated below.
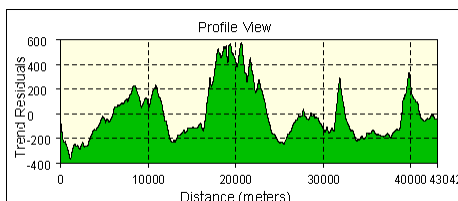

(over)
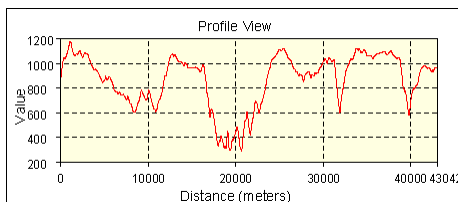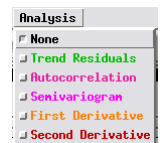
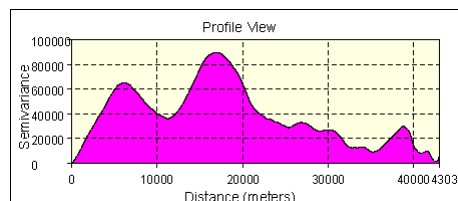Profile plot that forms the basis for the illustrated statistics plots.
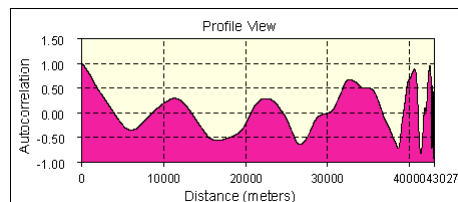
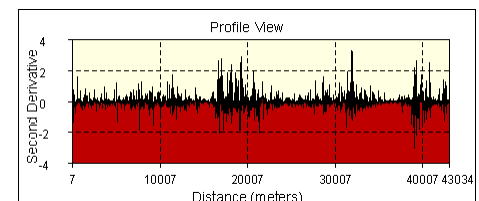Autocorrelation compares neighboring profile values and computes their correlation.
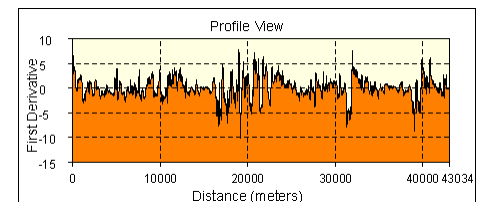
The First Derivative plots the slope of the profile line versus distance.

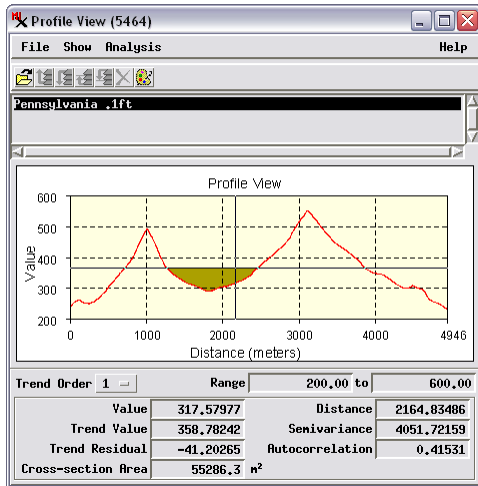Residuals are the differences between actual values and the trend values.

The Semivariogram compares neighboring profile values and calculates their relatedness.

The Second Derivative plots the change in slope of the profile line versus distance.

Cross-sectional Area

The Profile View window provides a Cross-section Area field that works in conjunction with the cross-hairs graphic. This field shows the area between the profile plot and the horizontal cross-hair line for the plot segment bracketing the vertical cross-hair position. In order for an area value to be shown, the profiled object must be a web terrain tileset or an elevation raster for which the Value type and Units have been set (see the QuickGuide entitled *Terrain Layer Value Type and Units*). In addition, the horizontal cross-hair must intersect the profile on both sides of the vertical cross-hair position. If there are multiple intersections, you can move the vertical cross-hair laterally to see area measurements of the different profile segments, as illustrated below. Area measurements are shown for profile segments that are either above or below the horizontal cross-hair.
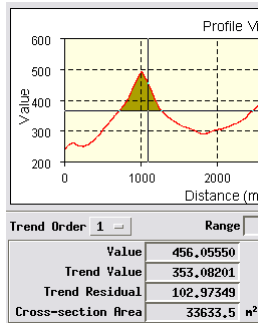
The Cross-section Area field shows the area of a closed shape formed by the profile line's two intersections of the horizontal cross-hair line around the vertical cross-hair. The profile line can be either below (left) or above (right) the horizontal cross-hair.
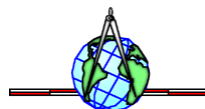
Save Profile Plot and Statistics

The Save option on the Profile View's File menu saves a comma-separated text file with the profile information in a form that can be easily imported to a spreadsheet. Fields in this file record the X and Y coordinates of each profile point, the 2D and 3D distances from the origin, and trend line information specific to the trend order set when the file is saved: the trend value, residual, semivariance, and autocorrelation. An excerpt of a profile text file is shown below.

X, Y, Distance2D, Distance3D, Value, Order 1 Trend, Trend Residual, Semivariance, Autocorrelation
-13516699.1, 4777629.9, 0, 0, 184.1, 297.7, 113.6, 0, 1
-13516670, 4777654.6, 38.2, 38.2, 184.3, 298.4, 114.1, 11.8, 1
-13516641, 4777679.4, 76.4, 76.4, 185.5, 299.1, 113.6, 45.4, 1
-13516611.9, 4777704.2, 114.6, 114.7, 187.8, 299.9, 112, 97.2, 1
-13516582.8, 4777729, 152.8, 153, 190.7, 300.6, 109.9, 163.1, 1
-13516553.8, 4777753.8, 191, 191.3, 193.6, 301.3, 107.7, 238.7, 1
-13516524.7, 4777778.6, 229.2, 229.6, 196.2, 302.1, 105.9, 320.6, 1

The Statistics option on the File menu opens a Profile Statistics window with summary statistics for the profile, including the number of points, profile length, minimum, maximum and mean values, variance, and standard deviation. Coefficients of the polynomial trend line of the currently specified order are also shown. You can save these statistics to a text file using the Save As button on the Profile Statistics window.