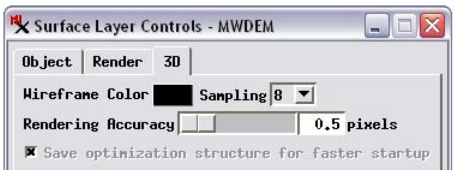
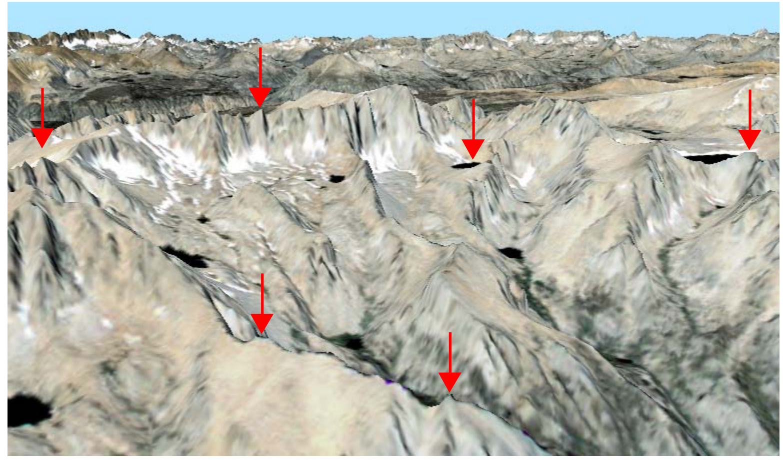
Control Accuracy of Terrain Rendering

3D perspective views in TNTmips model the terrain surface as a variable-resolution triangular mesh of elevation values. Foreground and high-relief areas that require high detail are represented by small triangles that can accurately show small terrain features. Background and low-relief areas that require less detail are covered by larger triangles that average out local terrain variations. This triangulation model is reconstructed each time the 3D viewpoint changes, so its accuracy and computation time are both important.

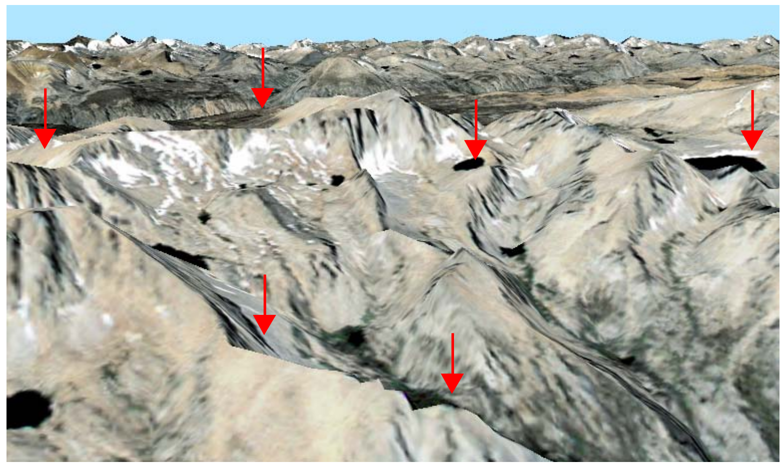
The elevation of each triangle vertex equals the elevation in the corresponding terrain raster cell. The edges and faces of larger triangles, however, can deviate in elevation from the terrain raster cells they cross or span, respectively. You can control the overall accuracy and level of detail of the variable surface triangulation using the Error Tolerance control on the 3D tabbed panel of the Surface Layer Controls window.



The Error Tolerance value sets the maximum allowed vertical deviation between any triangle edge or face in the terrain model and the corresponding elevations of the cells in the terrain raster. These deviations translate directly to offsets up or down in the 3D view, so the Error Tolerance value is measured in screen pixels. The minimum allowed value (for highest accuracy and terrain detail) is 0.5 pixel: a maximum 0.5 screen pixel offset up or down between any part of the triangulation model and the terrain raster elevations, a deviation too small to be noticeable. The maximum allowed value is 10: with this setting some portions of the terrain model may deviate in elevation from the terrain raster by as much as 10 screen pixels up or down, a difference that is readily evident in the 3D view. The illustrations above right provide an example of the differences in terrain rendering accuracy between the lowest and highest Error Tolerance settings.



Error Tolerance = 0.5 Best Surface Accuracy and Detail Fast Display



Error Tolerance = 10.0 Less Surface Detail Fastest Display

The above illustrations compare the terrain accuracy for the lowest (most accurate, top) and highest (least accurate, bottom) Error Tolerance settings for a mountainous terrain with high local relief. The differences in terrain detail between these settings can be seen easily at the locations marked by the red arrows. Changes in the Error Tolerance value generally produce more noticeable effects in the middle and background of a scene than in the foreground.

Decreasing the Error Tolerance value causes large triangles to be split into smaller, more accurate triangles but slows rendering times because more triangles must be processed. Conversely, rendering to a sparser, more generalized terrain model speeds up rendering. You can therefore use a high Error Tolerance setting to provide faster, less accurate previews while adjusting the view geometry. When you are ready for final rendering, decrease the Error Tolerance for a more accurate terrain model. The table to the right shows representative display times at different Error Tolerance values for several moderate to large sample terrains that each use a single color-composite raster texture (drape layer). The rendering time difference during initial display may be larger if you use more complex data (terrain raster with floating-point values, multiple texture layers, RGB or RGBI raster layers, transparency, and so on). The time difference across the range of Error Tolerance settings decreases dramatically during subsequent redisplay (even when changing the viewpoint) because the TNTmips Display process routinely caches the last-used texture and terrain data in memory for fast access when the 3D view is redrawn.

Comparative Display Times*

Data	Error Tolerance	Display Time	Redisplay Time
Canyonlands, Utah Terrain raster: 4891 x 4685 cells Drape raster: 9776 x 9311 cells	0.5	9.4 sec	3.6 sec
	10	4.0 sec	3.0 sec
Mount Shasta, California Terrain and drape rasters both 5286 x 6987 cells	0.5	11.8 sec	6.1 sec
	10	8.0 sec	5.7 sec

* Using single 24-bit composite raster for drape with MipMap Anisotropic texture filter and 16-bit integer terrain raster, on a 2.33 GHz Intel Core2 Quad CPU with 2.0 GB RAM.