

# Uniform Perceptual Contrast Color Palettes

Many color palettes commonly used to display images of continuous-value surfaces, such as ground elevation and geophysical measures of gravity and magnetics, do not provide uniform color contrast for every portion of the color range presented. In some portions of these palettes the color changes rapidly for a given change in palette index position, while in other portions there is little change in color, leading to perceptual “flat spots”. Local surface features with raster value ranges falling in a perceptual flat spot cannot be visually differentiated from the surrounding areas.

TNTmips, TNTedit, and TNTview provide a set of Uniform Perceptual Contrast color palettes that were designed by Dr. Peter Kovesi of the Centre for Exploration Targeting at the University of Western Australia. Each of these palettes was designed to have uniform perceptual contrast in color and brightness across the whole color range. This means that a given separation in color index position in the palette (such as 10 steps) should be equally visually distinguishable regardless of where in the palette the pair of color indices are located.

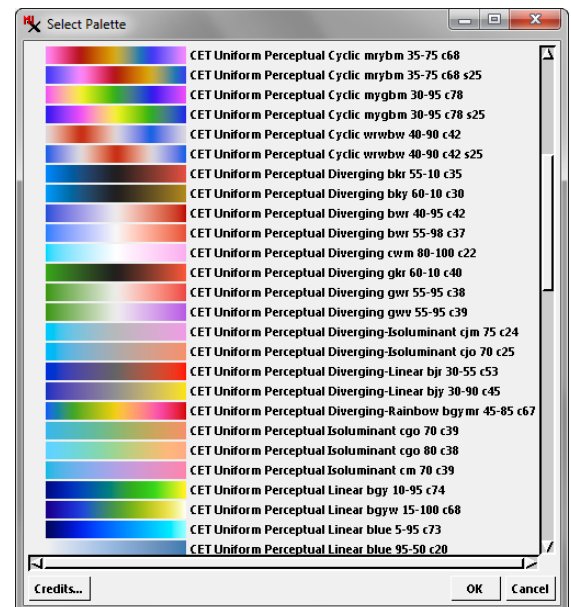
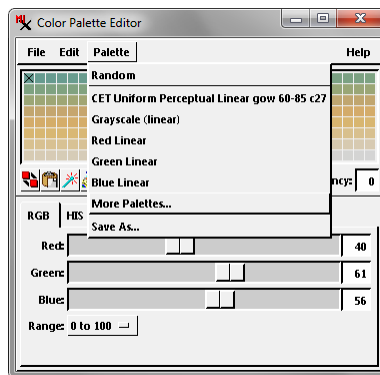
These palettes can be selected (along with other standard palettes) for display of raster layers via the Color Palette Editor. From this window choose Palette / More Palettes to open the Select Palettes window. These palettes can also be used to provide the elevation color of terrain surface layers and for LIDAR layers (when styling points by elevation and in terrain-renderings from the points) using their respective Layer Controls windows.

The Uniform Perceptual Contrast (UPC) palettes were designed with one or more properties that describe the color spread and/or component colors. The palette names include the palette property or properties as well as abbreviations of the colors used (e.g., “cgo” signifies a spread from cyan to green to orange). The palette properties are described below.

**Linear** palettes have color lightness values that increase or decrease linearly over the entire color range. These palettes are designed for general use.

**Rainbow** palettes use multiple spreads involving a number of bright anchor colors. Standard rainbow palettes commonly have colors of differing brightness and include several reversals in the direction of brightness gradients that can interfere with the

(continued)



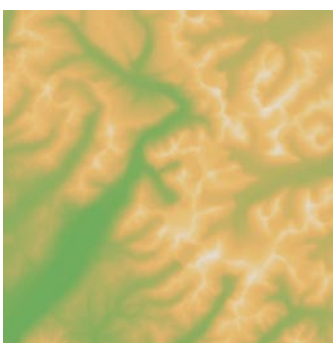
The Select Palette window lists all available color palettes, showing both the palette colors and palette name.

For more information about these color palettes:

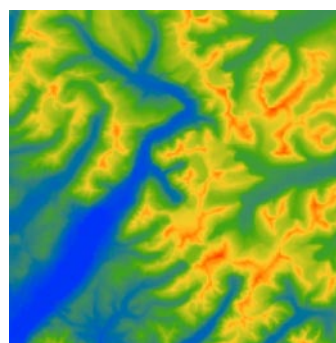
[www.cet.edu.au/research-projects/colourmaps](http://www.cet.edu.au/research-projects/colourmaps)

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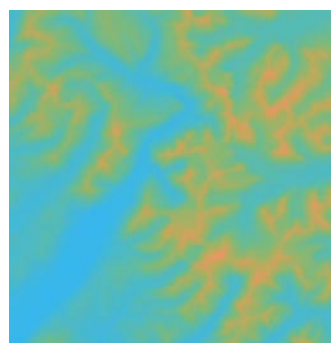
## Examples of Uniform Perceptual Contrast Color Palettes Applied to Elevation Data



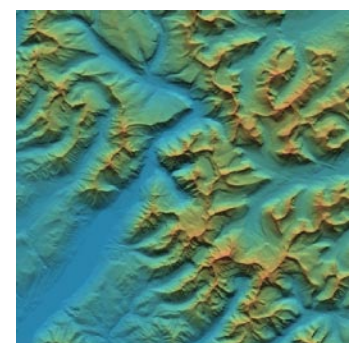
Linear, green-orange-white



Rainbow, blue-green-yellow-red



Isoluminant, cyan-green-orange



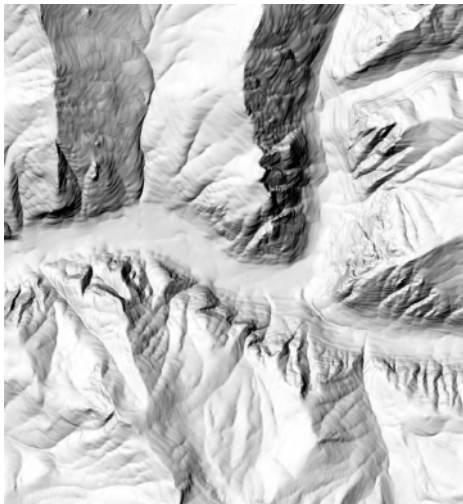
Isoluminant, cyan-green-orange blended with relief shading

viewer's perceptual ordering of the colors. The UPC rainbow palettes were designed to minimize the brightness gradient reversals and perceptual flat spots typically found in standard rainbow palettes.

**Cyclic** palettes have colors that match at each end. They are intended for use with rasters representing compass direction or other angular phase data. An example illustrated below shows a cyclic palette used for a topographic aspect raster, which records the azimuth angle (0 to 360 clockwise from north) of the slope direction. Using a cyclic palette ensures that compass directions of 1 and 359 degrees (which represent almost the same direction) are represented by nearly identical colors in the display.

**Isoluminant** palettes are constructed from colors of equal perceptual lightness. The lack of brightness contrast in these palettes means that they are not well-suited for use with raw grayscale raster values (see illustration on the previous page). Rather, they are designed for rendering surfaces using a blend of relief-shading and elevation color. Color-shaded rendering options are provided for terrain surface layers and for LIDAR layers.

**Diverging** palettes are designed to display data that has a well-defined reference value and when it is important to differentiate values lying above and below the reference value. An example is gravity or magnetic anomaly data in which values can be negative or positive (0 is the reference value). Diverging palettes include a pair of spreads away from the center. Each side of the palette uses a different color spread but have mirrored lightness spreads. The center index of the diverging palettes is either white, black, or gray. Diverging palettes are provided with several different spread types: linear, rainbow, and isoluminant.



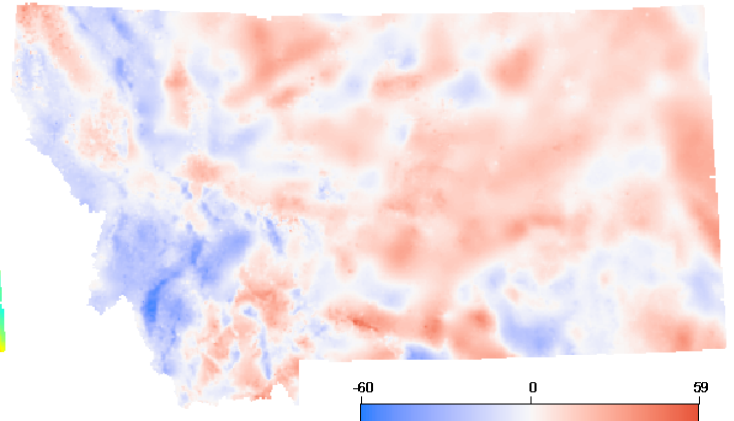
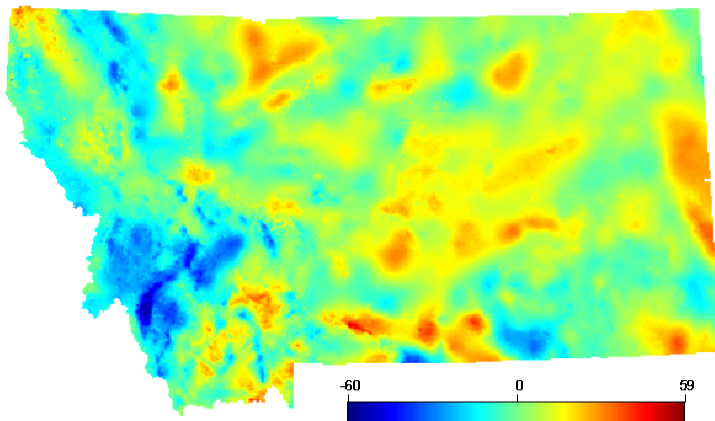
Relief shading computed from elevation raster of a mountain valley system, for reference to aspect images shown to the right.



Aspect raster displayed with standard rainbow color palette. Note the juxtaposition of red and blue colors along the south wall of the major valley for nearly equivalent slope directions on either side of north.



Aspect raster displayed with cyclic uniform perceptual contrast color palette with matching colors at either end. Note smooth transition between colors for northwest and northeast-facing slopes on south wall of major valley.



Gravity anomaly images of the state of Montana (USA) with values ranging from -60 to +59. Left, shown with standard rainbow color palette. Right, shown with diverging palette centered on white = 0, negative values in blue, positive values in red. The diverging palette makes it easier to differentiate positive and negative gravity anomaly values.