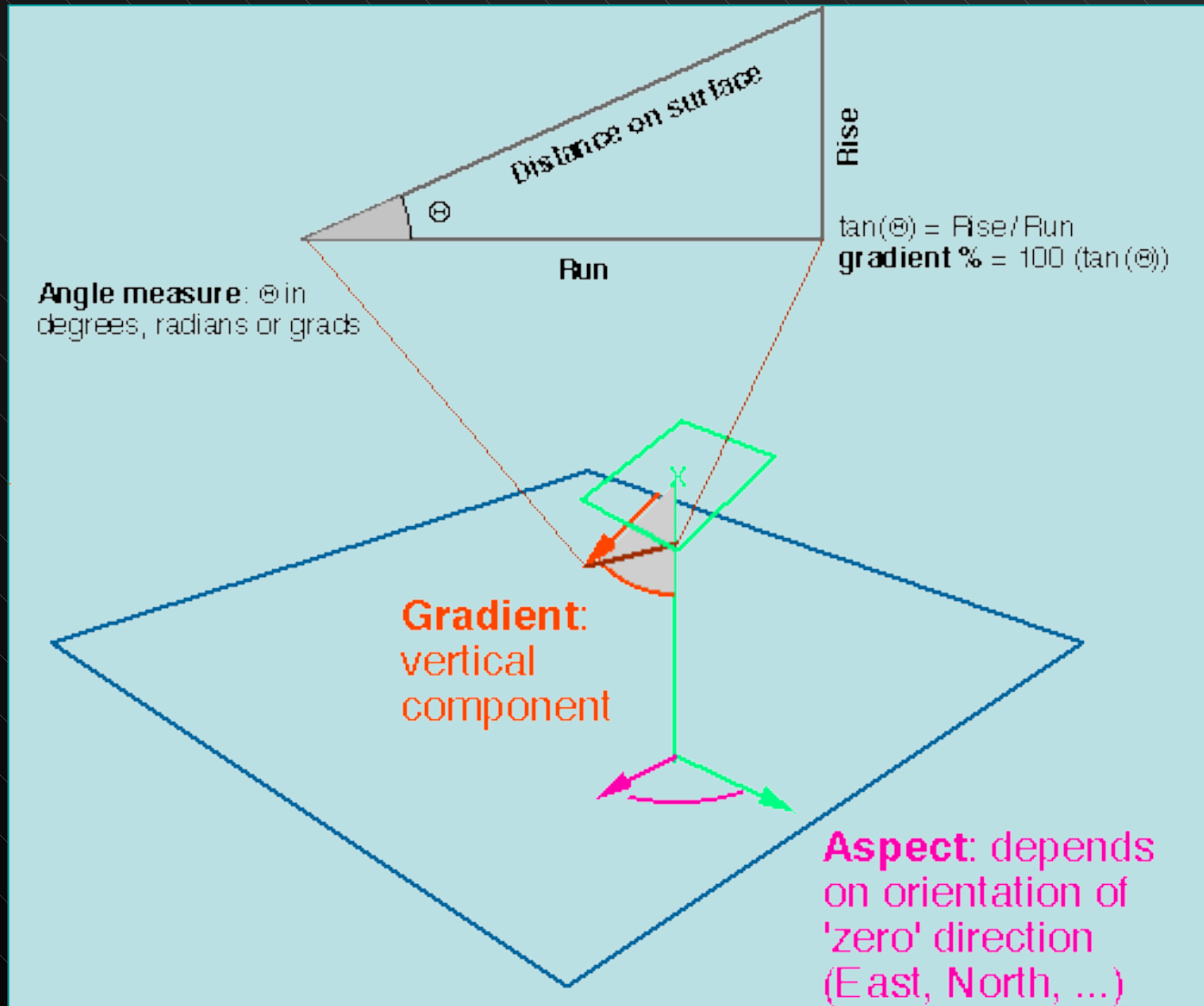


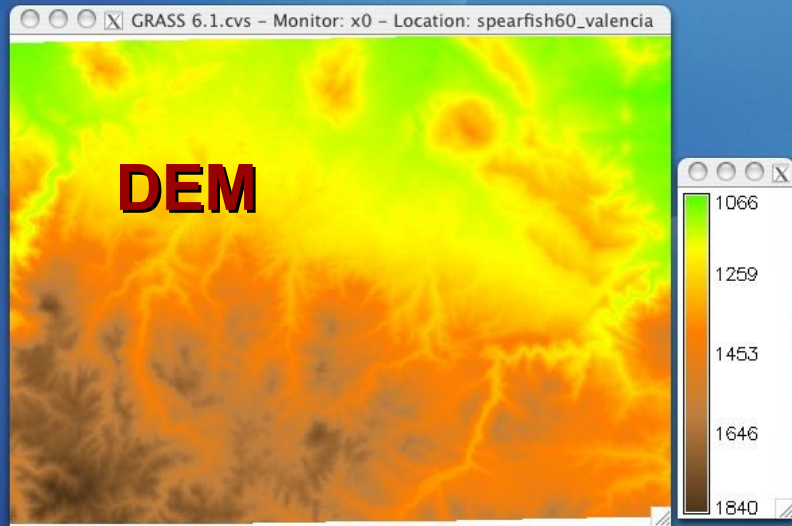
# DEM/DTM

- Simple concept
- Not the way we normally conceive of the world spatially (remember world view)
- World as a surface
- Make possible a very diverse and powerful array of analytical methods for surfaces of all kinds
- Originally developed for landscape topography, but have subsequently been used for many other surfaces

# DEM: Terrain Analysis



# DEM: Terrain Analysis



GRASS 6.1.cvs - Monitor: x0 - Location: spearfish60\_valencia

r.slope.aspect

Generates raster map layers of slope, aspect, curvatures and partial derivatives

Raster elevation file name (string, required):  
elevation.dem

Output slope filename (string, optional):  
slope

Format for reporting the slope (string, optional):  
degrees

Type of output aspect and slope maps (string, optional):  
float

Output aspect filename (string, optional):  
aspect

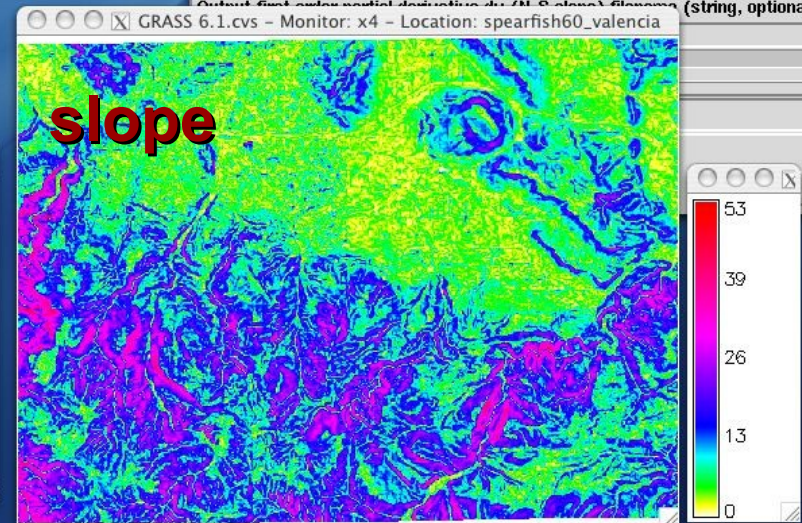
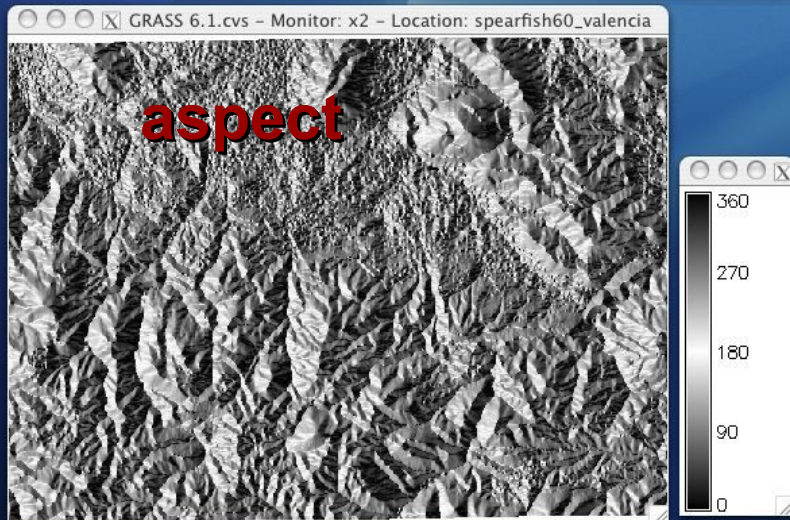
Output profile curvature filename (string, optional):

Output tangential curvature filename (string, optional):

Output first order partial derivative dx (E-W slope) filename (string, optional):

Output first order partial derivative dy (N-S slope) filename (string, optional):

This figure shows the GRASS GIS command-line interface for the 'r.slope.aspect' tool. The interface is a window titled 'r.slope.aspect' with a scrollable list of options. The options are: 'Raster elevation file name (string, required): elevation.dem', 'Output slope filename (string, optional): slope', 'Format for reporting the slope (string, optional): degrees', 'Type of output aspect and slope maps (string, optional): float', 'Output aspect filename (string, optional): aspect', 'Output profile curvature filename (string, optional):', 'Output tangential curvature filename (string, optional):', 'Output first order partial derivative dx (E-W slope) filename (string, optional):', and 'Output first order partial derivative dy (N-S slope) filename (string, optional):'. The 'Format for reporting the slope' is set to 'degrees' and the 'Type of output aspect and slope maps' is set to 'float'.



# DEM: Shaded Relief

The screenshot displays the GRASS GIS interface with three monitors. Monitor x0 shows a color-coded elevation map (DEM) with a gradient from blue (low elevation) to red (high elevation). Monitor x2 shows a grayscale shaded relief map of the same area, highlighting topographic features. Monitor x4 shows the final result: a geological map where the shaded relief is draped over a color-coded geology raster. The geology legend on the right lists nine categories: 1) metamorphic (green), 2) transition (purple), 3) igneous (orange), 4) sandstone (light green), 5) limestone (yellow-green), 6) shale (blue), 7) sandy shale (brown), 8) claysand (grey), and 9) sand (light blue).

**r.shaded.relief**  
Creates shaded relief map from an elevation map (DEM).

Elevation map (Name CANNOT contain dashes '-' or dots '.'). (string, required):  
> elevation10m

Shaded relief map name (string, optional):  
> elevation10m\_shaded

Altitude of the sun in degrees above the horizon (must be 1-89). (integer, optional):  
30

Azimuth of the sun in degrees to the east of north (must be 0-360). (integer, optional):  
270

Factor for exaggerating relief (default=1). (float, optional):  
1

Scale factor for converting horizontal units to elevation units (default=1). (float, optional):  
1

Set scaling factor (applies to lat./long. locations only) (string, optional):

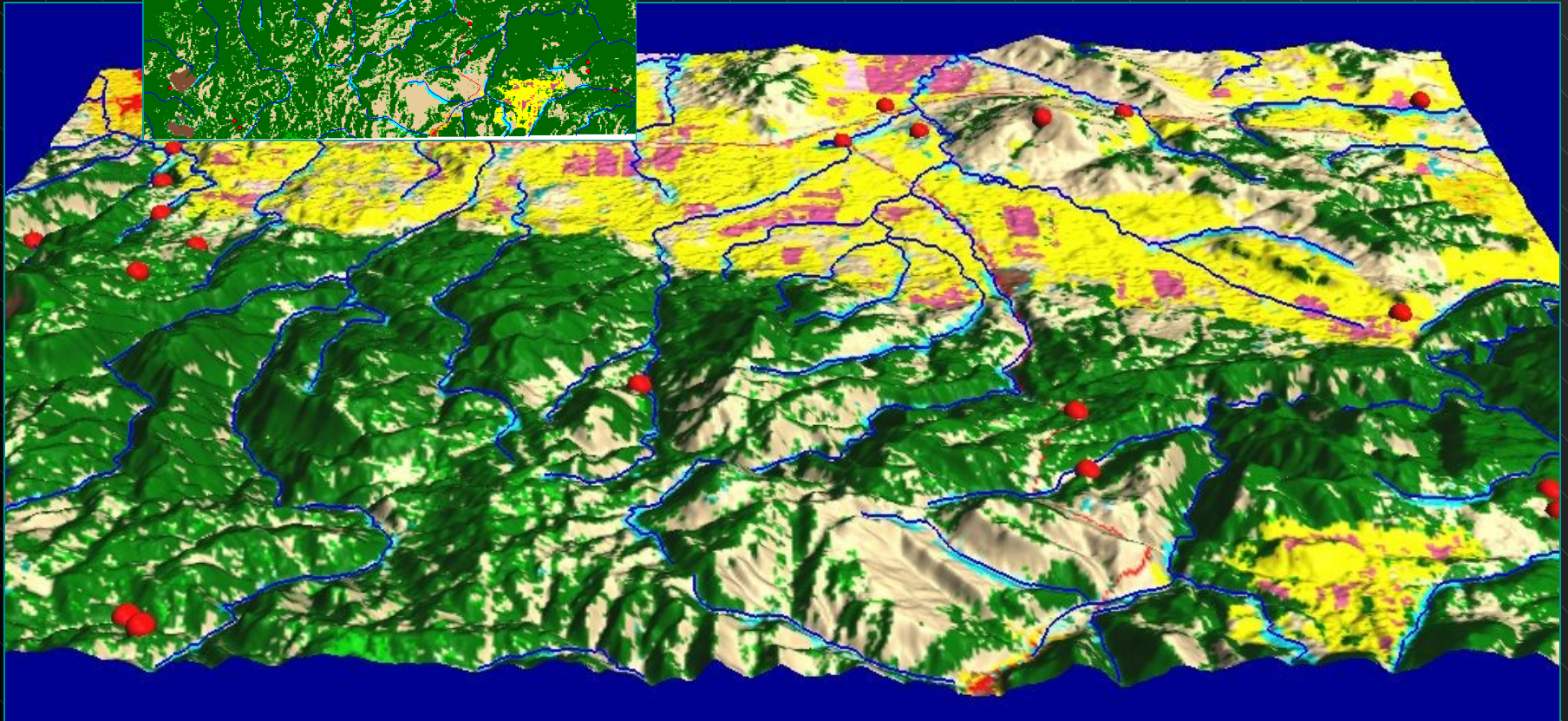
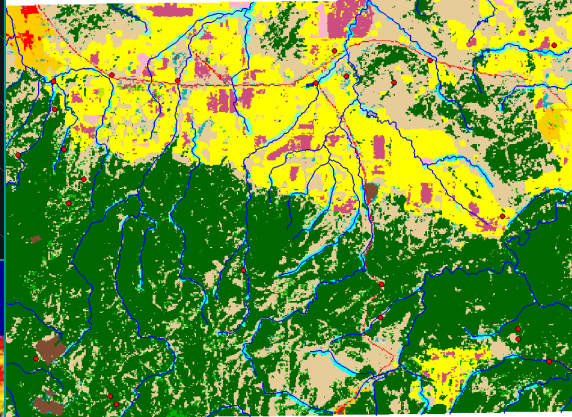
**d.shadedmap**  
d.shadedmap - Uses d.his to drape a color raster over a shaded relief map

Name of shaded relief or aspect map (string, required):  
> elevation10m\_shaded

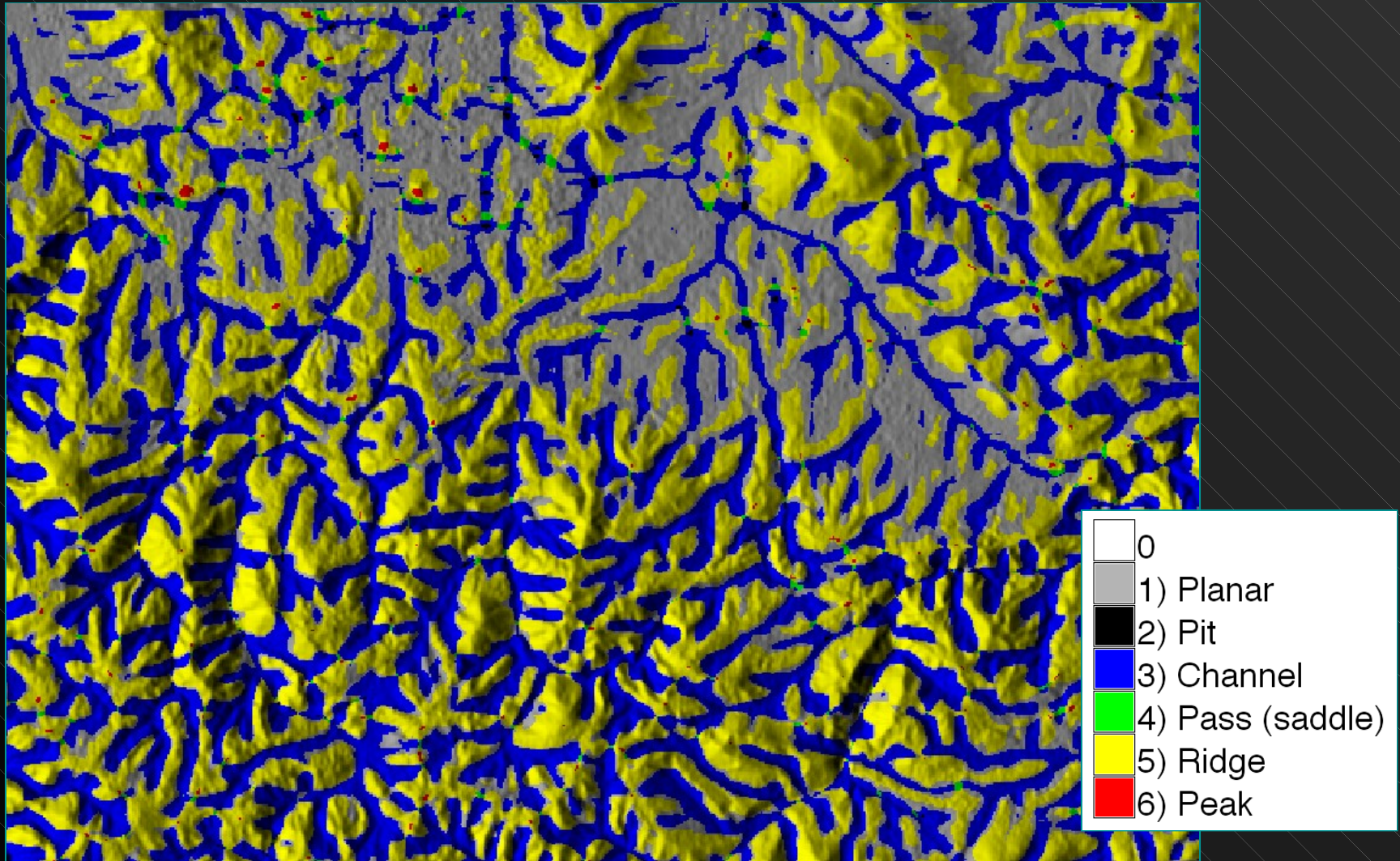
Name of raster to drape over relief map (string, required):  
> geology

- 1) metamorphic
- 2) transition
- 3) igneous
- 4) sandstone
- 5) limestone
- 6) shale
- 7) sandy shale
- 8) claysand
- 9) sand

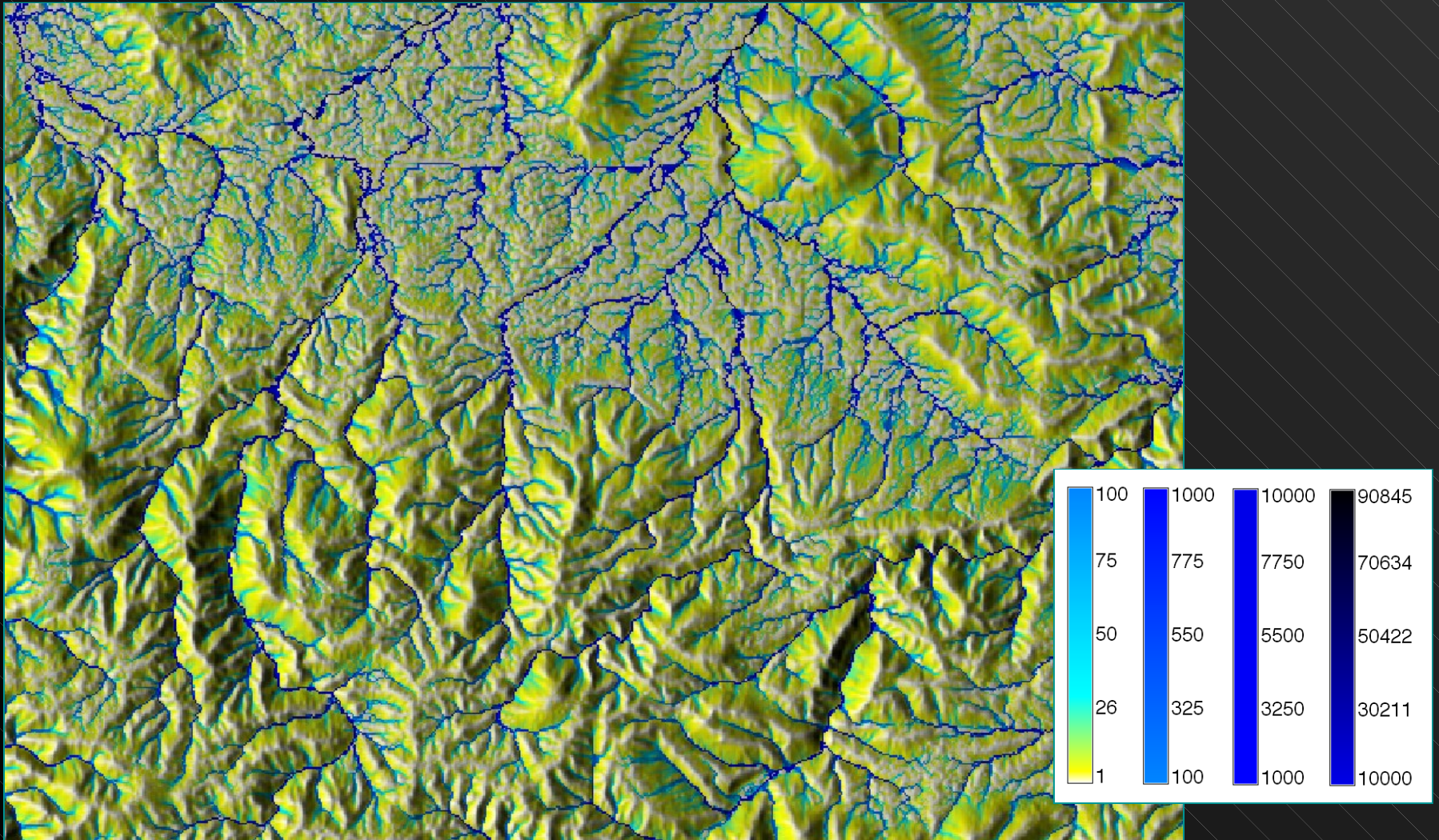
# DEM 2.5D Visualization



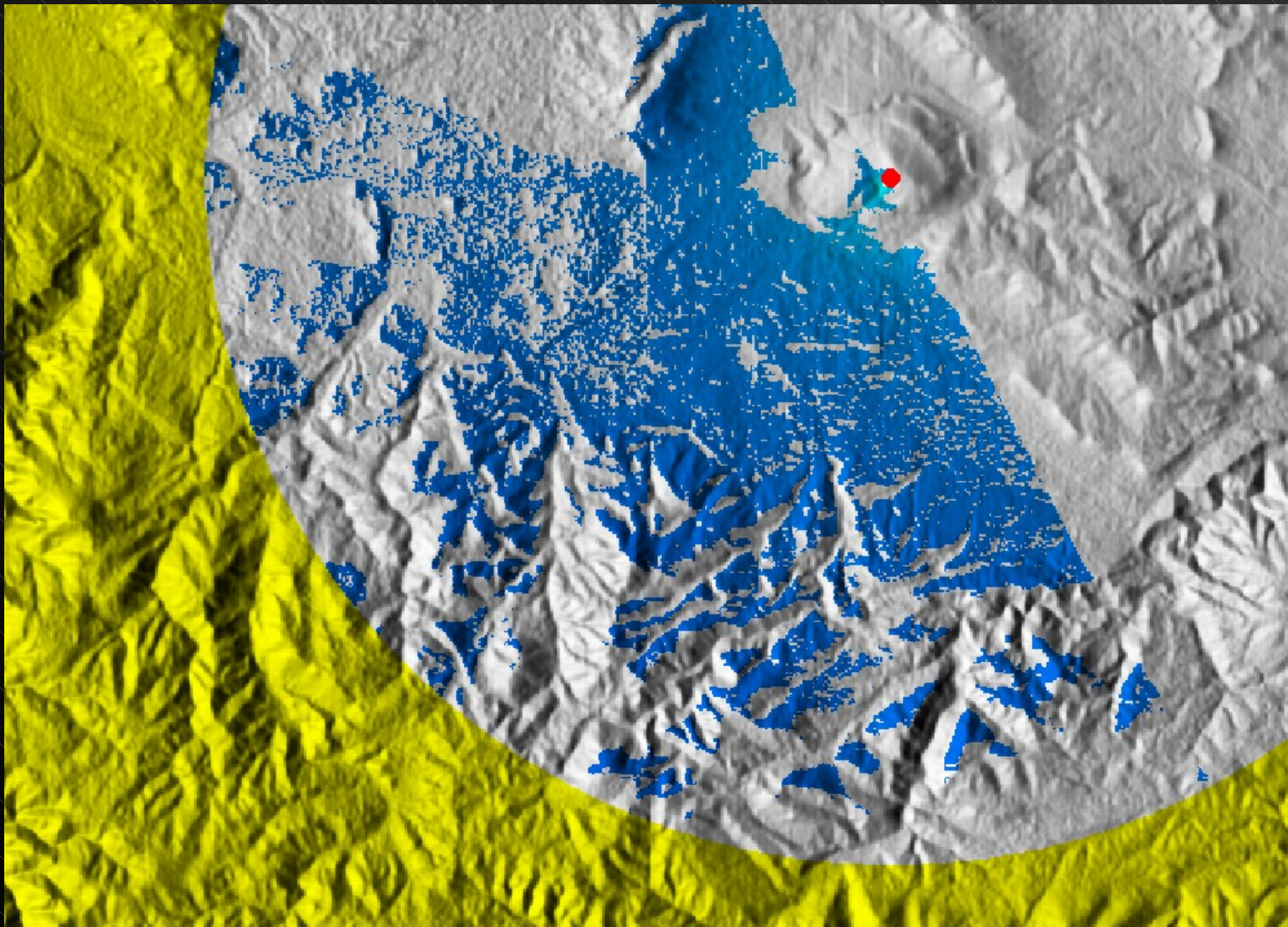
# DEM: Terrain Features



# DEM: Hydrology -Accumulation

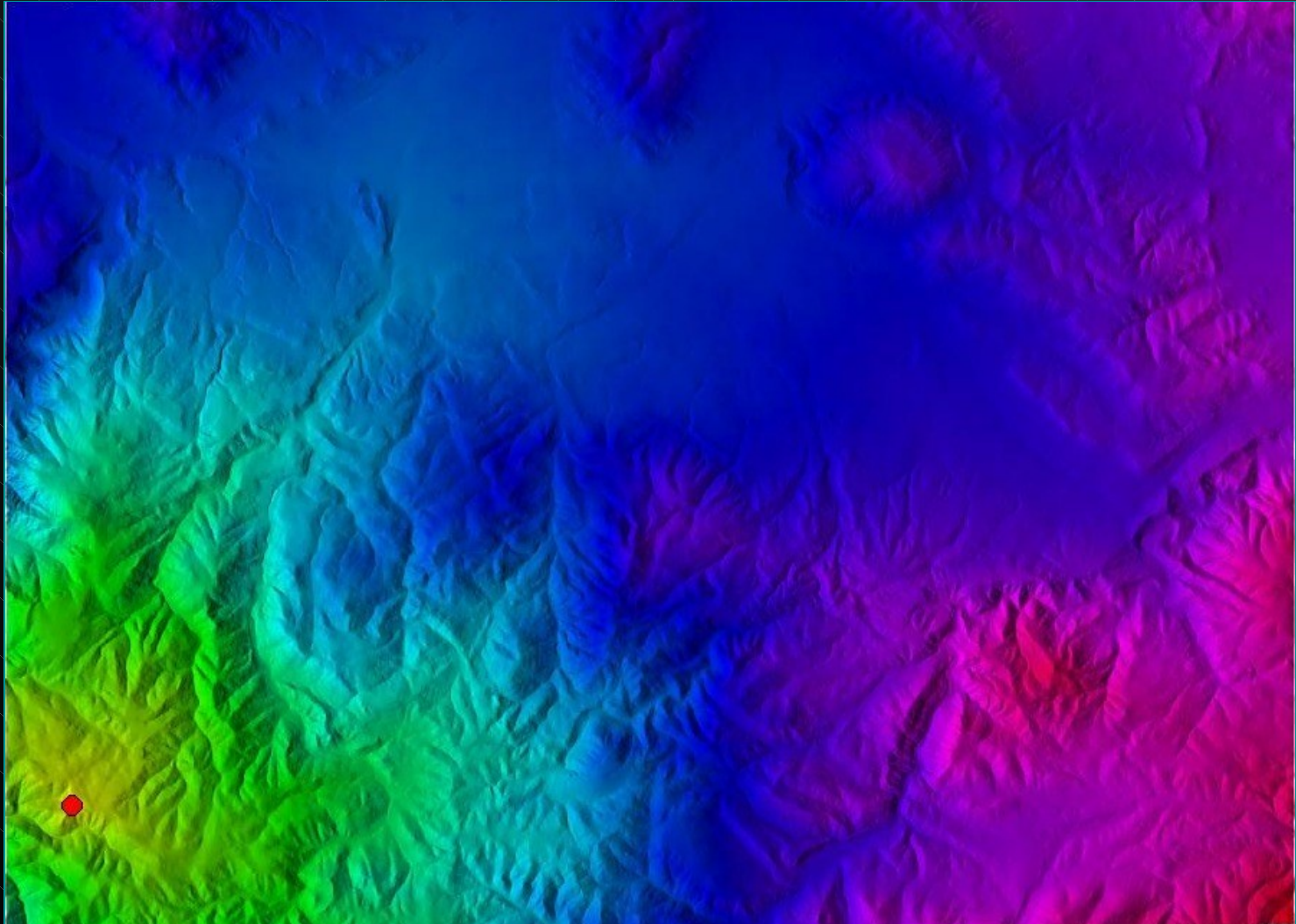


# DEM: Visibility - Viewsheds





# Cost Surfaces



# Cost Surfaces

Requires **point of origin**

**Distance**

Cell value = number of cells away from point o  
origin X width of cell in map units

**Friction surface**

Cell value = cost of traversing that cell

**Cost map = distance X friction for each cell**

**Isotropic vs. anisotropic**

# Imagery

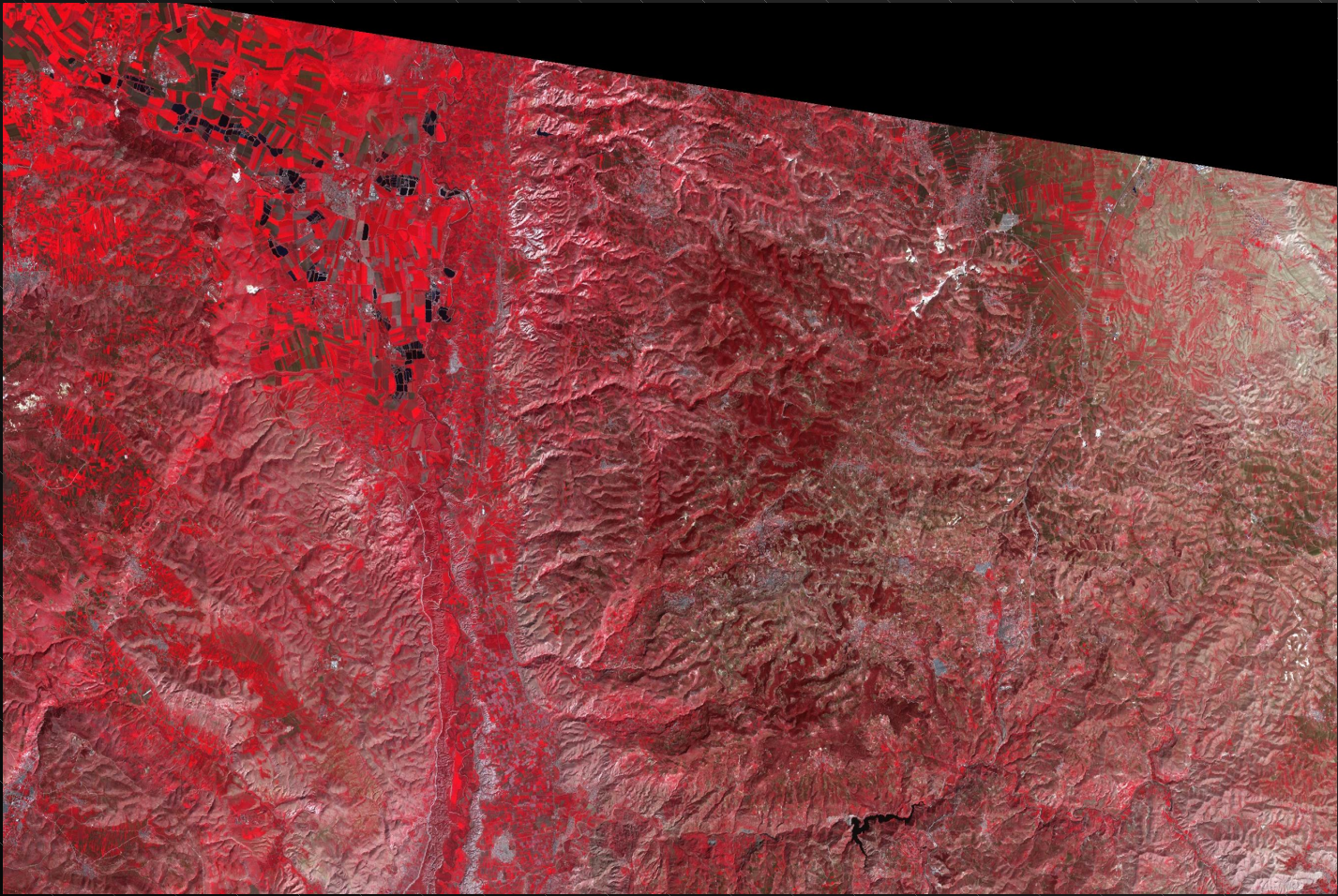
Landsat



Visible Color: Red, Green, and Blue Spectra

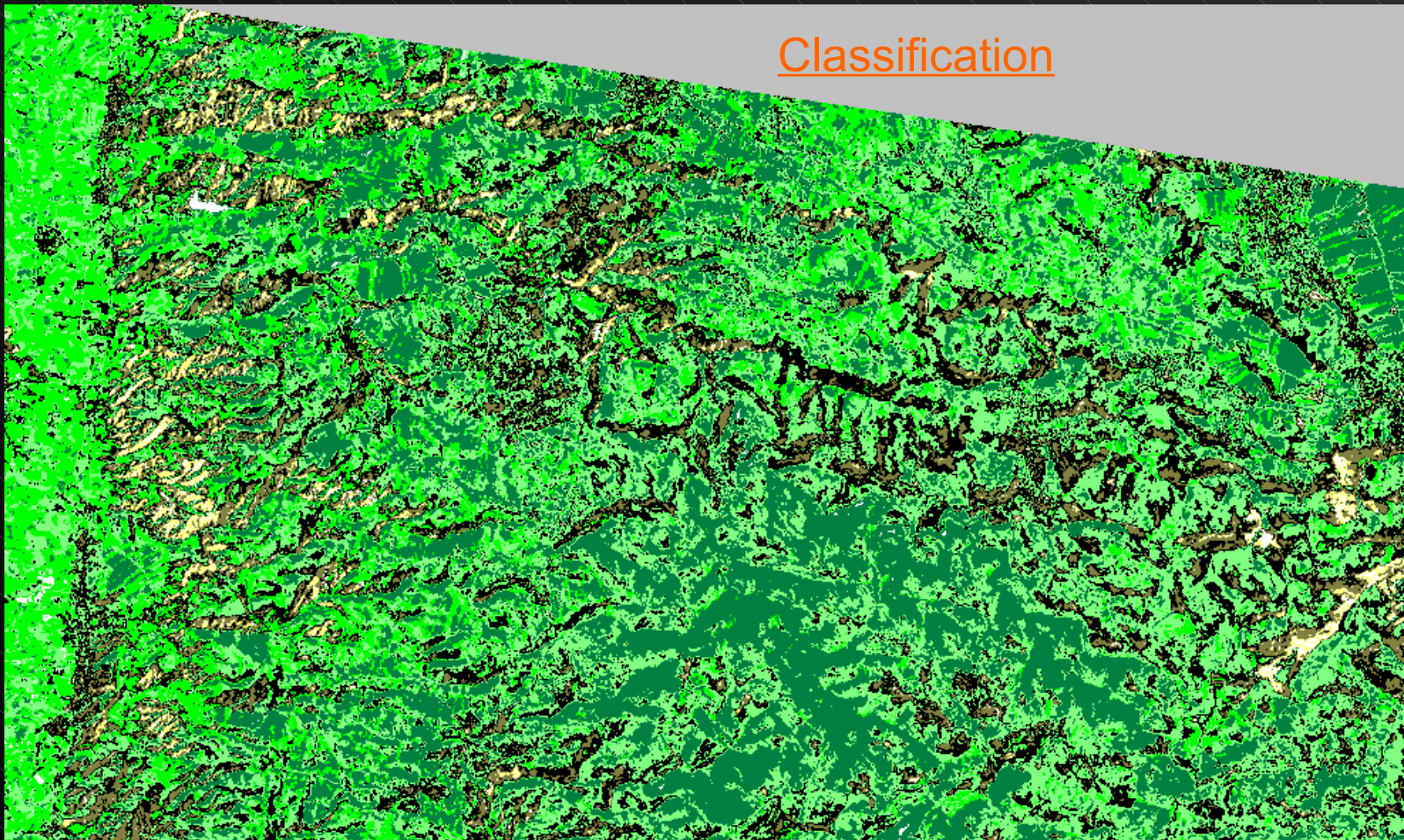
# Imagery

## Band Manipulation



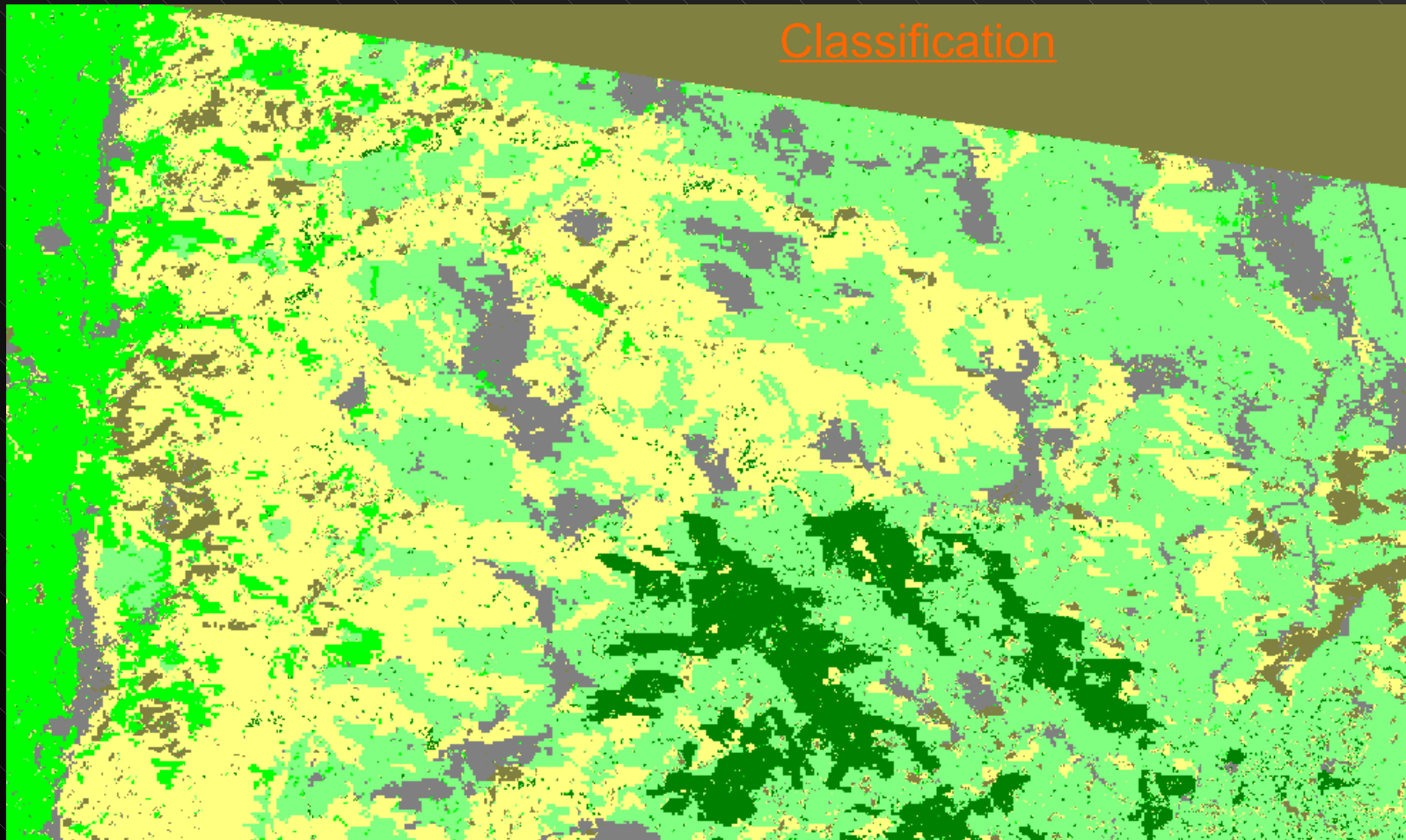
Growing Vegetation: Near Infra-red, Red, and Green Spectra

# Imagery - Landcover



Unsupervised (automatic) landcover classification

# Imagery - Landcover



Supervised (with user input) landcover classification