

# Hillshade Example

Custom product generation with elevation data

Version 1.0 Mark Lucas 22 May 2005

## *Overview*

### **Performing Artificial Shading based on Elevation**

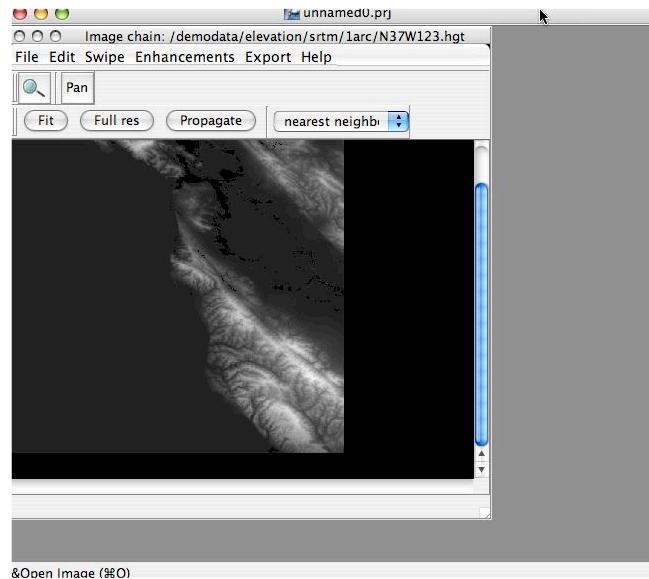
OSSIM and ImageLinker provide many capabilities for advanced custom processing. This example will demonstrate the topographic shading of a raster map based on an elevation data set. Normal vectors to the elevation surface are first calculated - essentially determining the slope of the terrain. These vectors are then used to calculate artificial shading based on an arbitrary light source. The roughness or steepness of all of the slopes can also be adjusted with a simple parameter. The results are then used to artificially shade a raster map.

So start up ImageLinker and follow the following steps:

## Open the source files

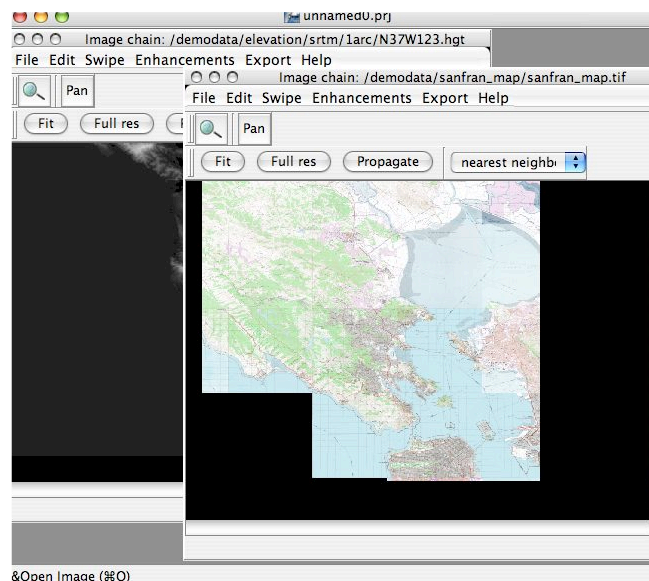
Open the corresponding elevation data cell and display. DTED or SRTM files can be loaded directly into a display. The sample data set includes distributable examples of SRTM data. OSSIM preserves the native resolution and radiometry of the file. Under the main menu open the SRTM file

**File->Open**, navigate to /demodata/elevation/srtm/1arc/N37W123.hgt



## Open the San Francisco Digital Raster map

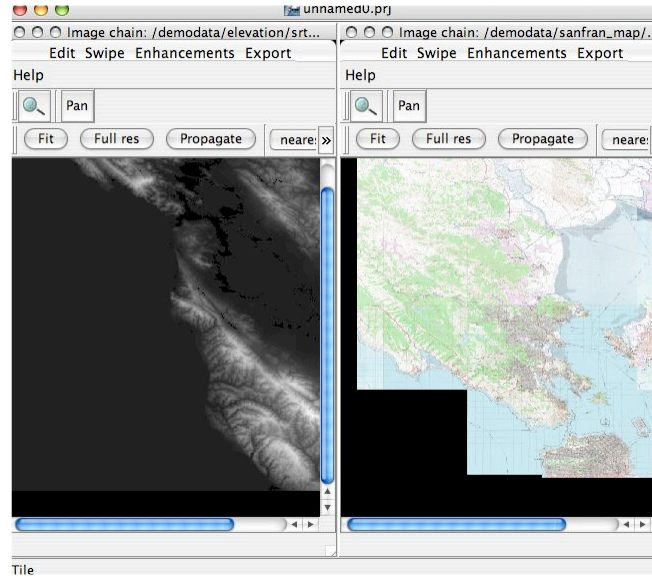
**File->Open**, navigate to /demodata/sanfran\_map/sanfran\_map.tif. Select and open the image.



## Tile the Windows

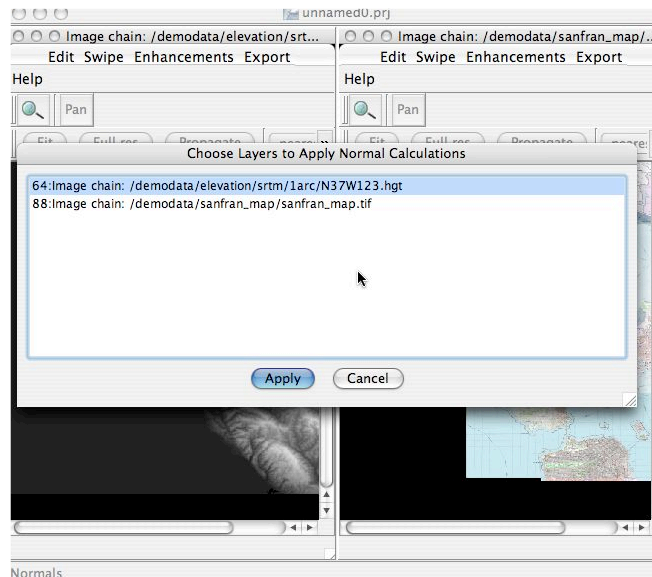
Place the images side by side by using the Tile menu command

Select **Window->Tile**

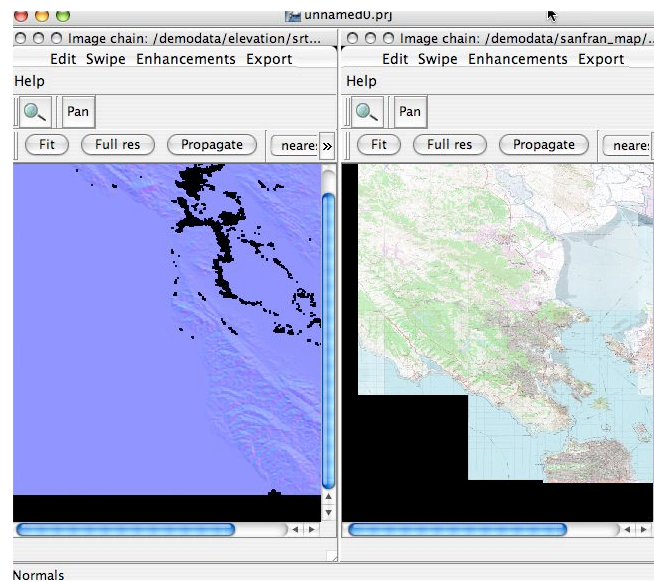


Calculate the normals on the elevation file. This step calculates normal vectors to the elevation surfaces. Elevation files are typically regular meshes of “posts” where each post is a sample of the height at a geographic location. Triangular meshes are typically generated using the posts as vertices so that the elevation in the areas between the posts can be interpolated. When we generate normals we are creating orthogonal vectors to the surfaces between the posts. This is a convenient indicator of the slope of the elevation surface for each triangular surface.

Under the main menu, select **Layers->Elevation->Normals** and select the elevation file



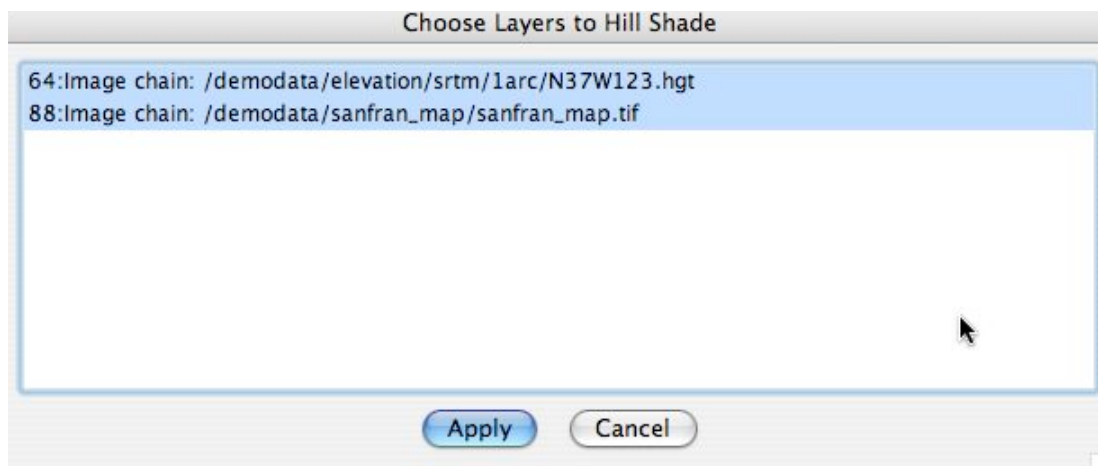
Press the **Apply** button



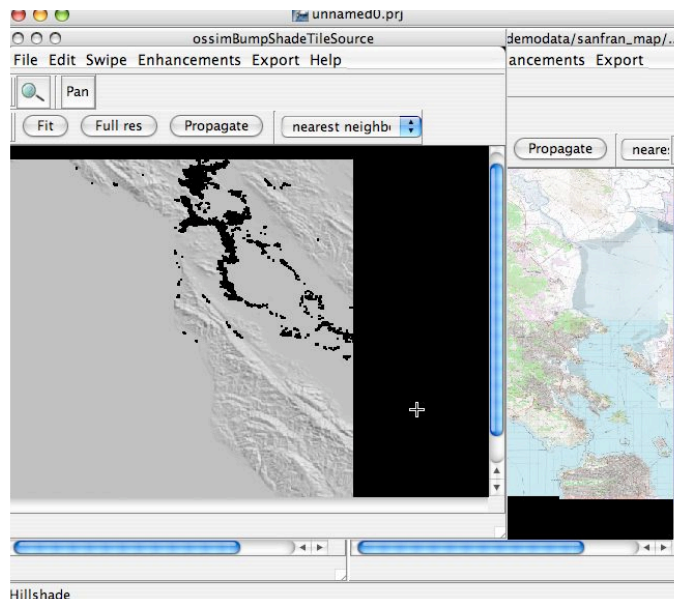
Execute the Hillshade menu item by selecting:

**Layer->Elevation->Hillshade**

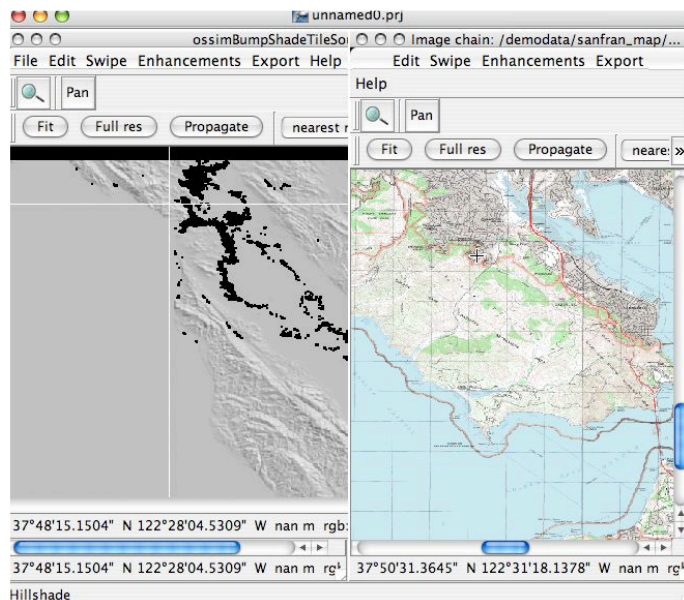
You should see the Choose Layers to Hill Shade dialog, select the N37W123.hgt image chain and the sanfran\_map.tif.



Press the **Apply** Button

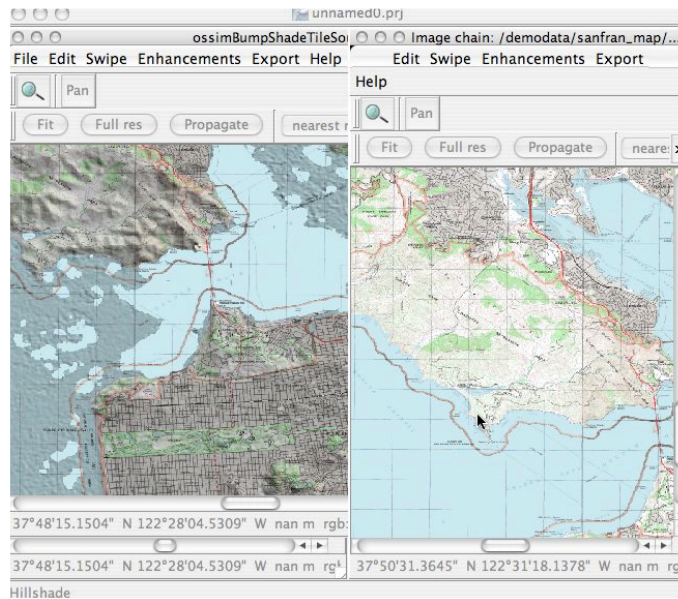


The area of coverage for the elevation cell is much larger than the footprint for the map. Select the Map display and zoom in to an area of interest as shown below:



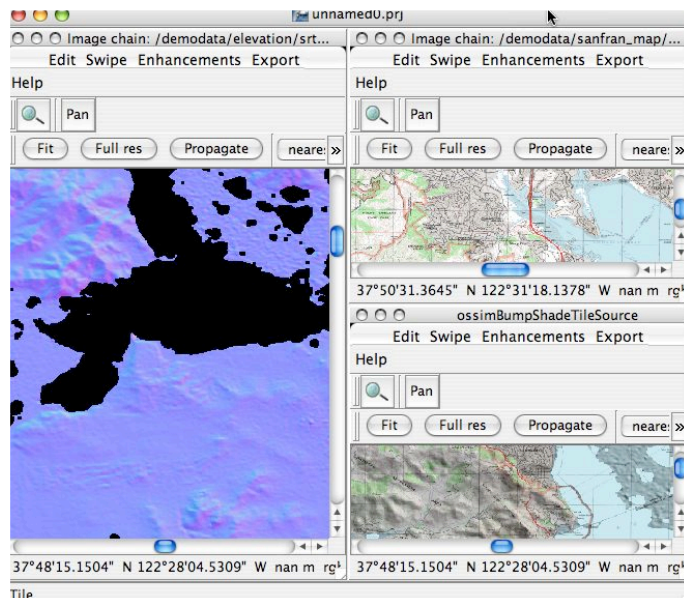
Press the **Propagate** button in the map display window to propagate the view to the elevation window.

## Propagate

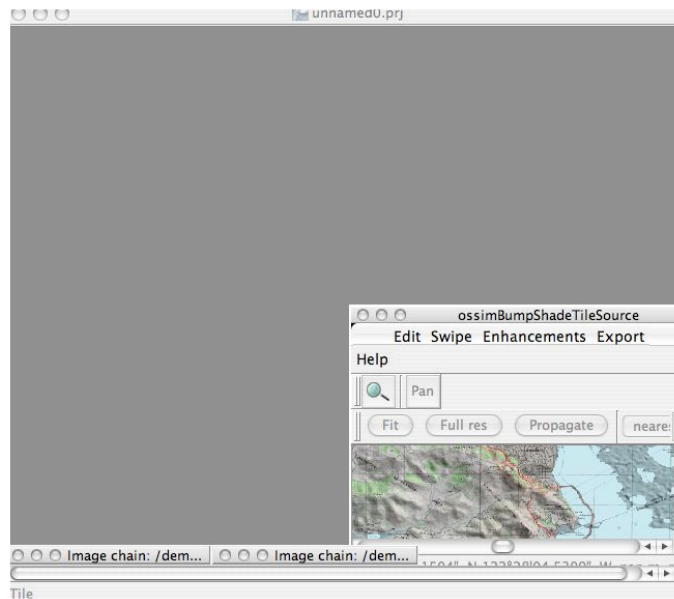


You can see some of the elevation shading as well as the areas where there is no valid elevation in the SRTM file. Use the tile command to organize the windows.

## Window-->Tile

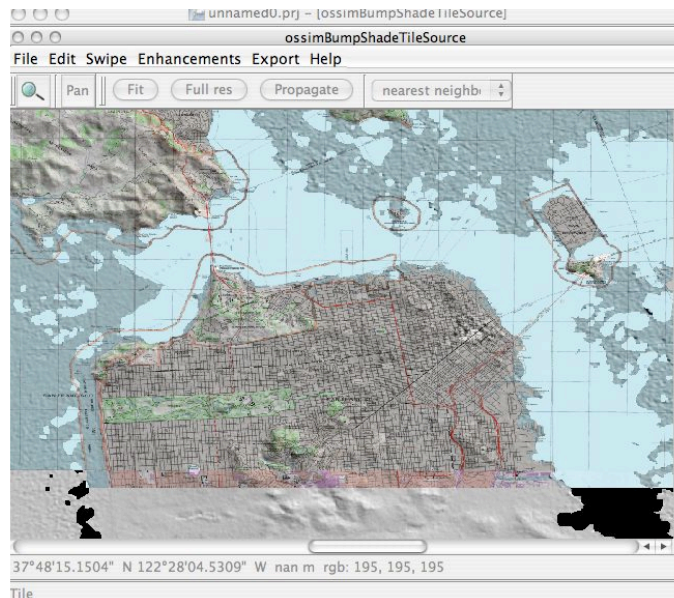


This displays all open windows, lets get minimize the elevation and map display so we can focus on the shaded terrain display. Click the minimize button in the elevation (left) and map (top right) windows.



Minimize the source windows

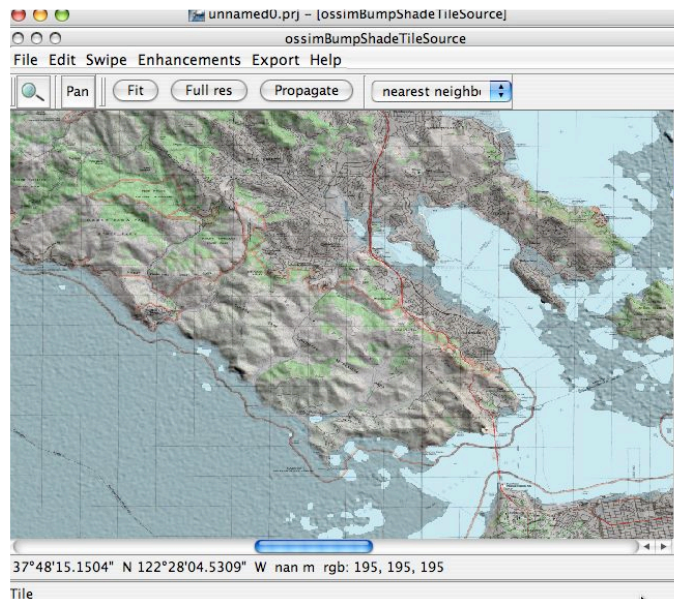
Now we can maximize the remaining hillshade display to occupy the canvas area.



### **Expand the Hillshaded Window**

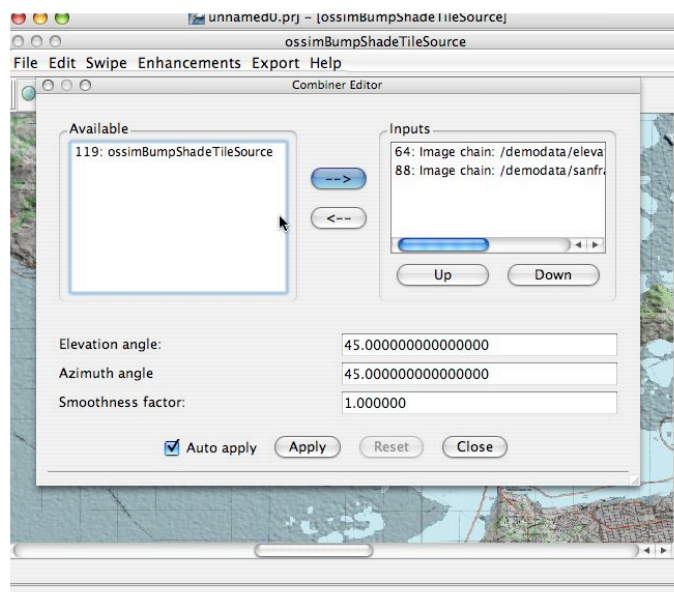
Next we will want to pan or scroll to the area in the upper left hand corner of the display where there is more terrain.

Scroll to the mountainous regions



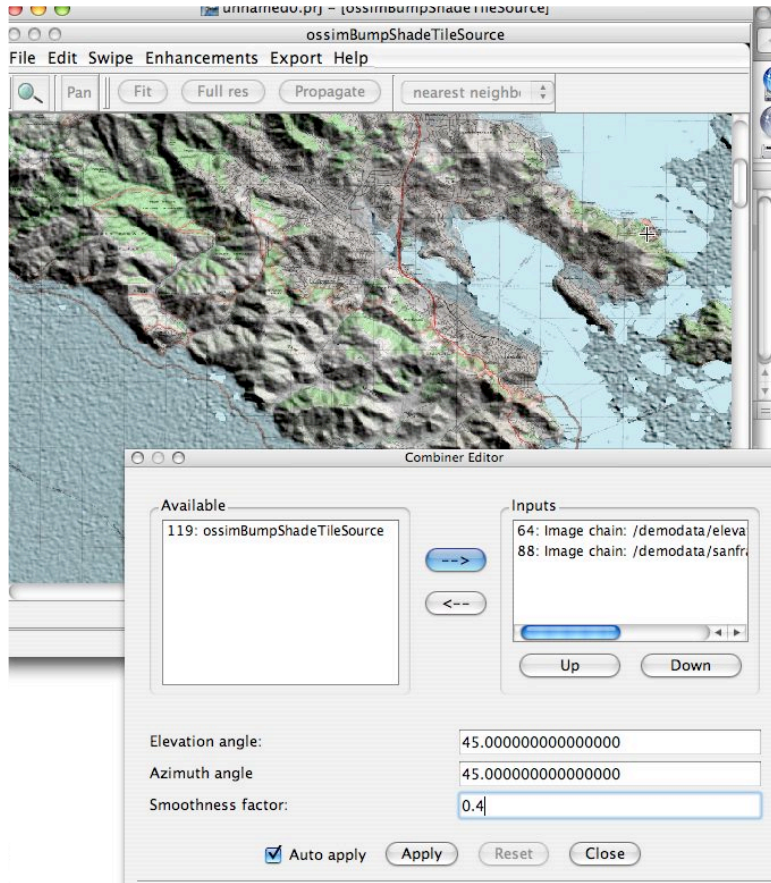
### Edit some parameters

Many of the functions in OSSIM have adjustable parameters. The same is true for the Hillshade example. In the display menu for the hillshade select **Edit-->Layers** to get to the hillshade parameters

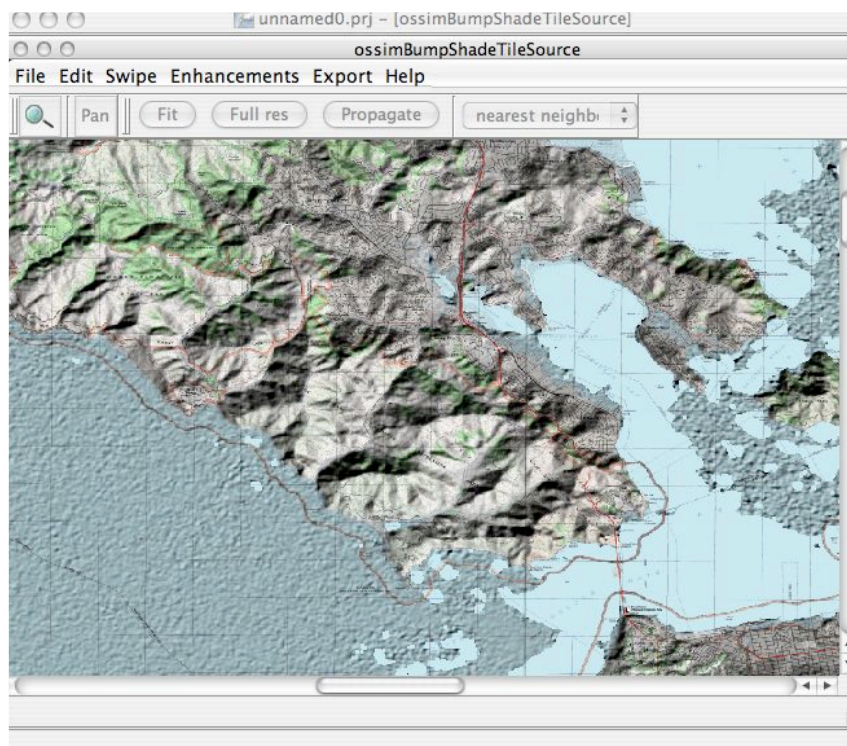




Change the roughness factor to 0.4 and press apply. This parameter effectively amplifies the slope.



Try changing the sun elevation and azimuth angles e.g. azimuth to 130



Now save your work in a project file so you can pick up at this point later.

**File->Save Project...**

Save the project as hillshade.prj. Later you can open hillshade.prg with the **File->Open Project** menu item to restore your session.

*Summary*

This completes a simple example of generating an image chain with elevation processing. An SRTM file was loaded along with a geotiff file of the San Francisco area. Normal vectors were calculated against the elevation surfaces and the results were used in a hillshade function to artificially shade the map. Adjustable parameters for the artificial position of the sun (azimuth and elevation) as well as surface roughness were modified to experiment with different shading.