GeoEarthScope "NCAL" San Andreas System LiDAR data tutorial

J Ramón Arrowsmith
Chris Crosby
School of Earth and Space Exploration
Arizona State University
ramon.arrowsmith@asu.edu
http://lidar.asu.edu

24 October 2007

Overview

This simple data and ArcGIS demonstration will illustrate:

- The spatial distribution of GeoEarthScope LiDAR data imaging the northern San Andreas Fault that was recently delivered from the National Center for Airborne Laser Mapping (NCALM)
- The data types and formats that will be available as GeoEarthScope LiDAR data
- How to display and manipulate the data in ArcMap
- Comparisons of the LiDAR data and standard Digital Elevation Model and Digital Orthophotography available from the US Geological Survey

Data included

(detailed data are for Sanborn Park area in the Santa Cruz Mountains, California)

Data	Data format	Resolution (m)	Source
Landsat 2000 Geocover	MrSID	~15	https://zulu.ssc.nasa.gov/mrsid/
USGS Quaternary Fault and Fold Database of the United States (extract)	Arc Shapefile		Downloaded from http://earthquake.usgs.gov/regional/qfaults/
USGS NED Digital Elevation Model	ArcGrid	10	Projected to UTM from data downloaded from http://seamless.usgs.gov
USGS Digital Orthophoto Quarter Quad aerial photograph	GeoTIFF	1	downloaded from http://seamless.usgs.gov
GeoEarthScope Lidar data tile outlines	Arc Shapefile		ASU
GeoEarthScope Lidar data tiles—unfiltered (all the data) and filtered (just ground returns) interpolated by kriging to make DEM. Includes hillshades	ArcGrid	0.5	NCALM
Canopy height	ArcGrid	0.5	ASU

These data are organized into an ArcMap 9.2 project (**GeoEarthScope_Sanborn.mxd**).

Data delivery scheme

We are receiving the data as its processing completes from the UC Berkeley arm of NCALM. In this demonstration, we will play with the filtered and unfiltered 1km x 1km ArcInfo grids @ 0.5m cell size and their shaded relief maps (NO overlap).

Due to ArcInfo file naming limitations, the grids contain only the significant digits from the lower left coordinate of their originating tile. For example, the ASCII tile named "f571000_4130000.xyz" corresponds to the ArcInfo elevation grid named "fg571_4130" and shaded relief map "fg571_4130shd". Filtered elevation grids are prefixed by "fg" and the hillshades end in "shd". Unfiltered elevation grids are prefixed by "ug" and the hillshades end in "shd"

For all these data the projection is UTM Zone 10N, WGS84 ellipsoid heights.

Pre-loaded Arc Map Demonstration

1) Launch ArcMap by double clicking the **GeoEarthScope_Sanborn.mxd** file. The background is the Landsat image. All of the little squares are the tile outlines.
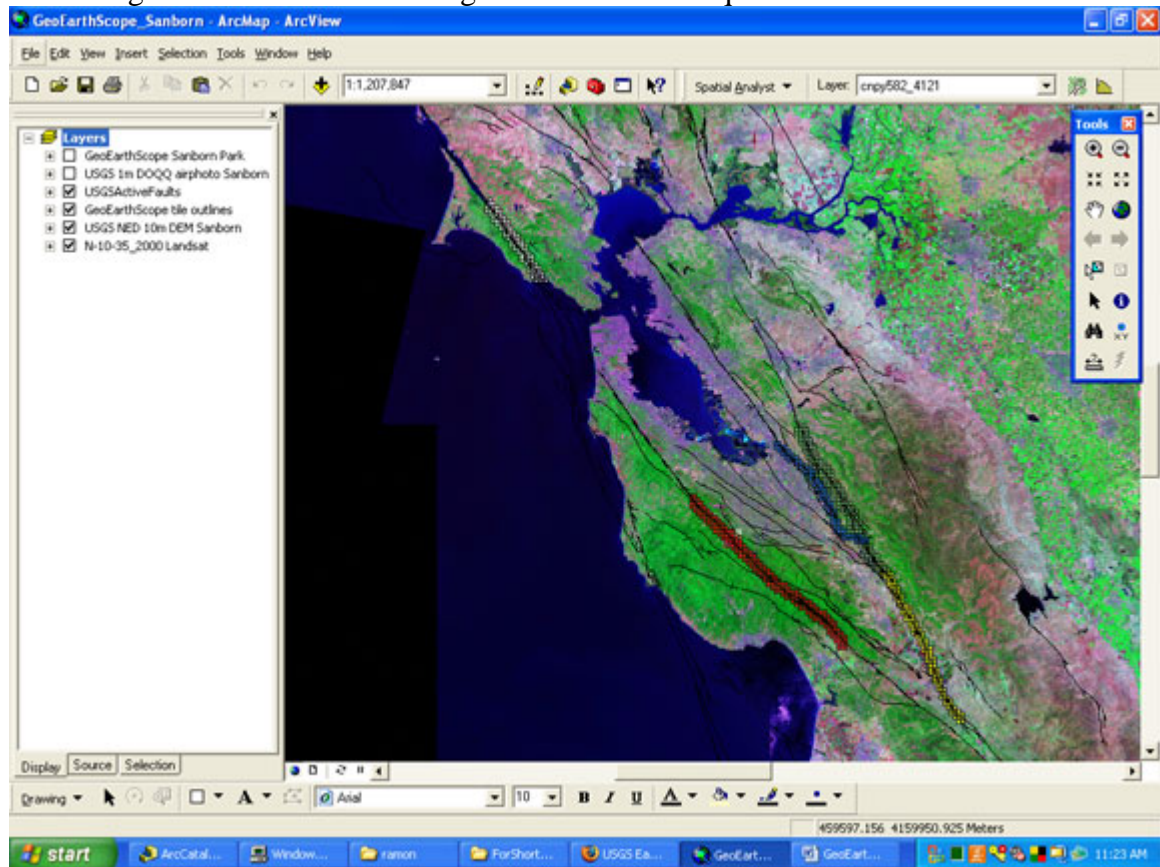
2) Right click on the *USGS NED 10m DEM Sanborn* Layer in the Table of Contents on the left and choose **Zoom to Layer**. Also, unclick the *GeoEarthScope tile outlines* Layer. You can thus see a rendering of the 10 m NED digital elevation model (DEM) color-coded by elevation and semi-transparent over the hillshade. Note also the black lines showing the USGS active fault mapping in the area.
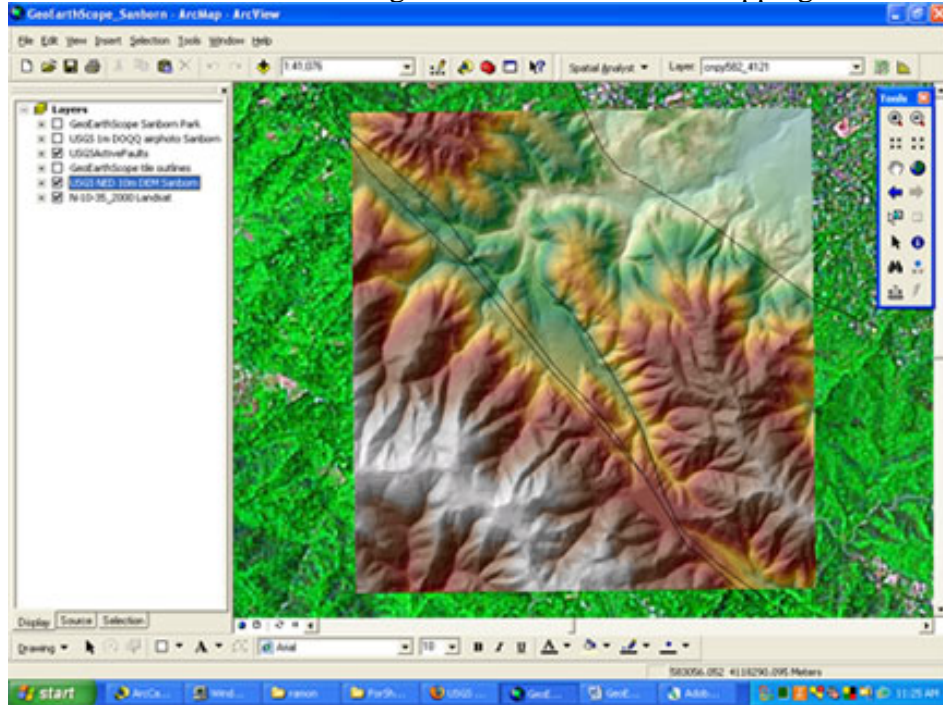

3) Turn off (by unclicking) the *USGS NED 10m DEM Sanborn* Layer, the *USGSActiveFaults* Layer and the *N-10-35_2000 Landsat* Layer and turn on (by clicking) the *USGS 1m DOQQ airphoto Sanborn* Layer in the Table of Contents.
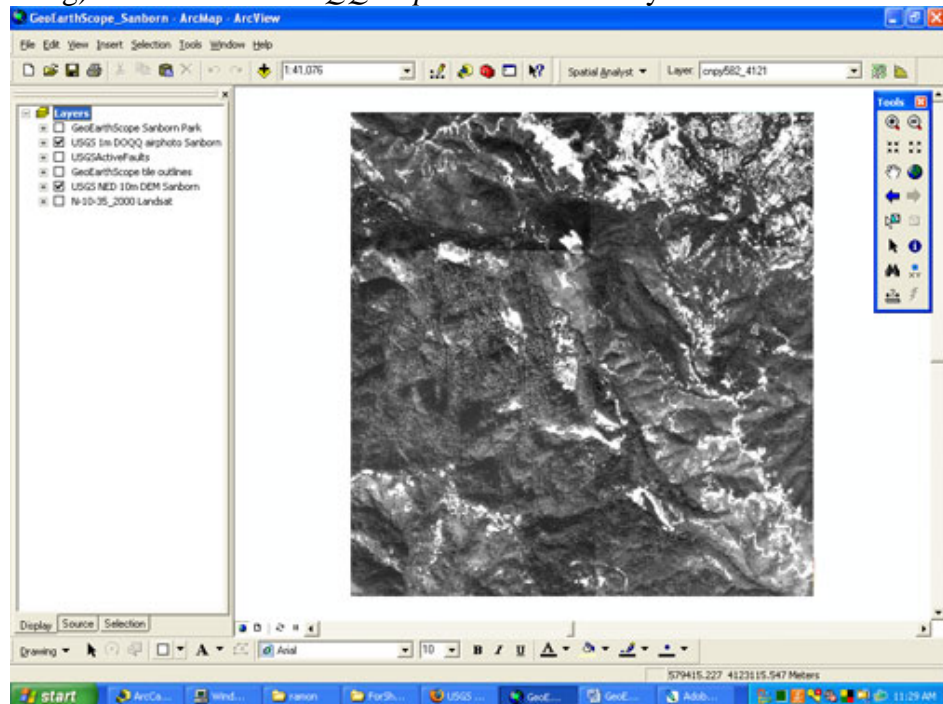
4) Right click on the *GeoEarthScope Sanborn Park* Layer in the Table of Contents and choose **Zoom to Layer**. Turn off the *USGS 1m DOQQ airphoto Sanborn* Layer. Open the *GeoEarthScope Sanborn Park* Layer by clicking on the + symbol and then turn on the *Sanborn Unfiltered* Layer. This is the 0.5 m DEM that was produced from *all* of the LiDAR returns. The line is there because the hillshades are one pixel narrower and thinner than the DEMs.
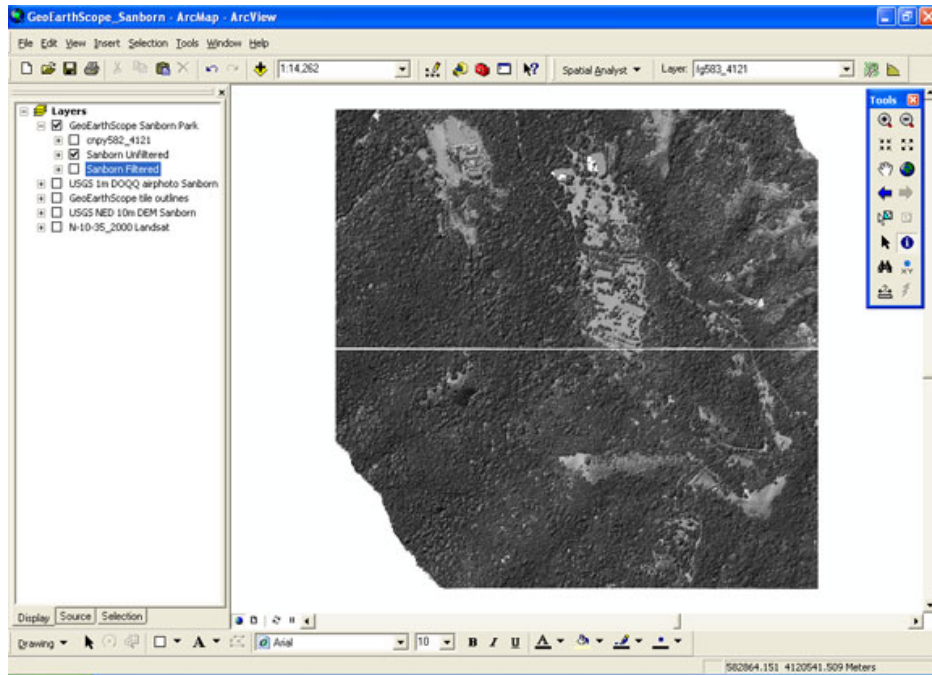
5) Alternate between the unfiltered and filtered ("bare earth") DEMS by clicking on the *Sanborn Filtered* Layer and then turning on and off the *Sanborn Unfiltered* Layer which is above it.
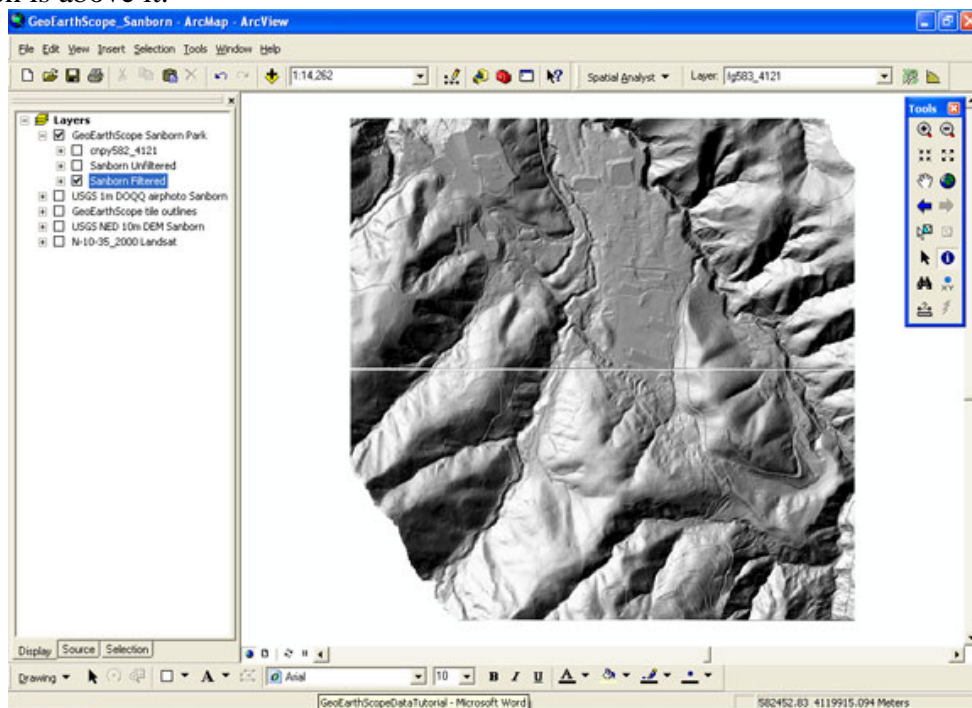
6) Open the *cnpy582_4121* Layer by clicking on the + symbol next to it. Right click on that layer and choose **Zoom to Layer**. This image was produced by subtracting the filtered tile from the unfiltered tile (using the Raster Calculator in Spatial Analyst in ArcMap). Our assumption that this difference in elevation is due to the presence of vegetation or "canopy." Thus, this is a crude map of canopy height. The range of values is indicated at the left in the Table of Contents.
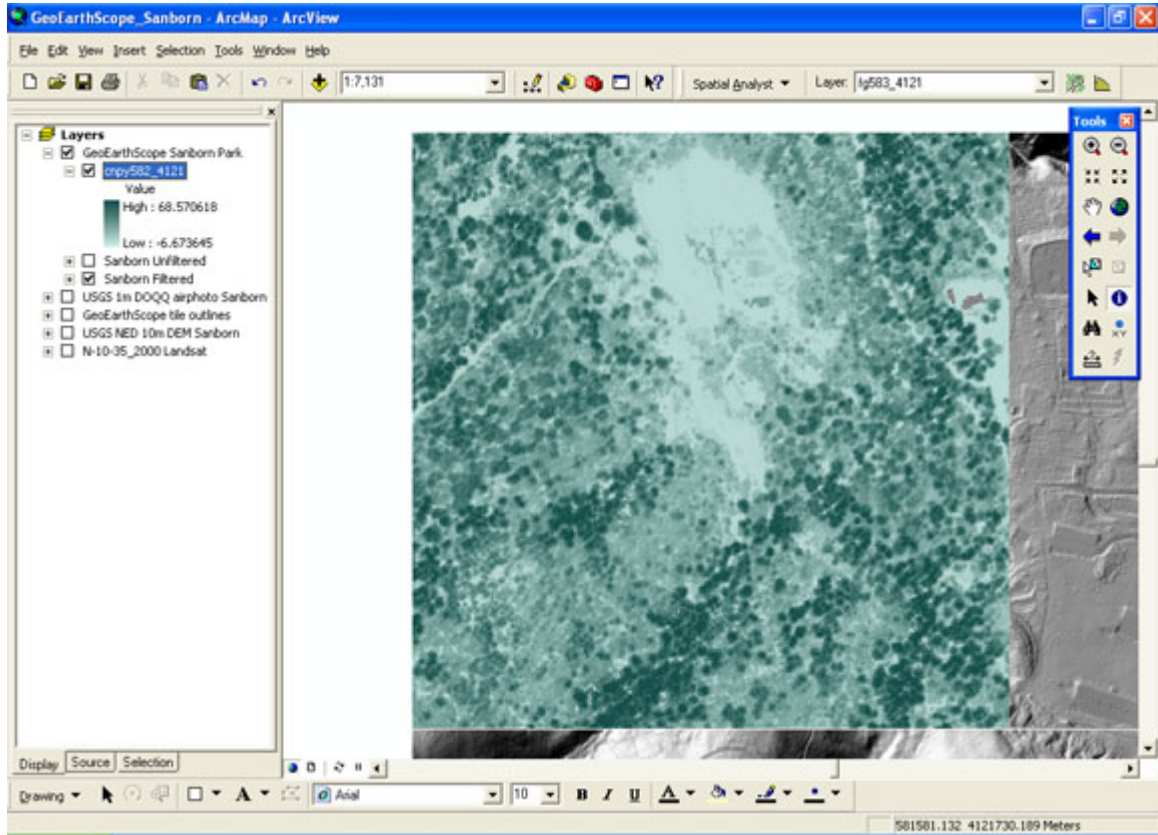
Arc Scene Demonstration

Viewing the Lidar data in a "3D" view can be astonishing and the viewer can often see many features not evident just in the map view. Thus, we will use the ArcScene program available as part of the ArcGIS suite.
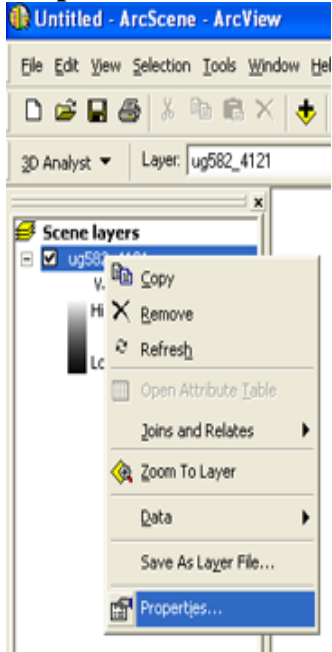
1) Quit ArcMap if you have not already and launch ArcScene from Start->All Programs->ArcGIS->ArcScene.
2) Click the plus symbol inside the yellow box to add some data:
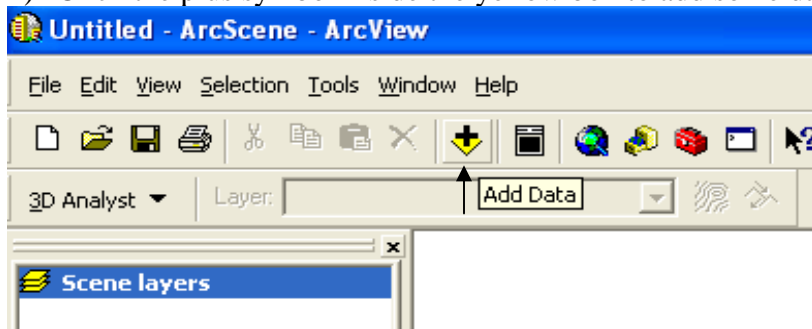
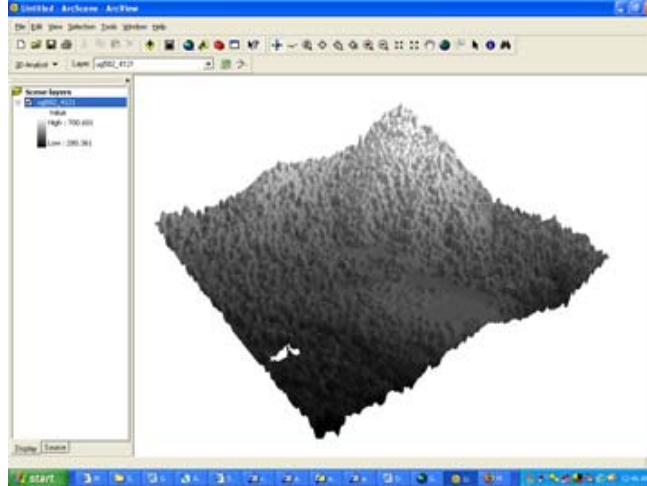3) Navigate to the Unfiltered data and choose the *ug582_4121* tile.
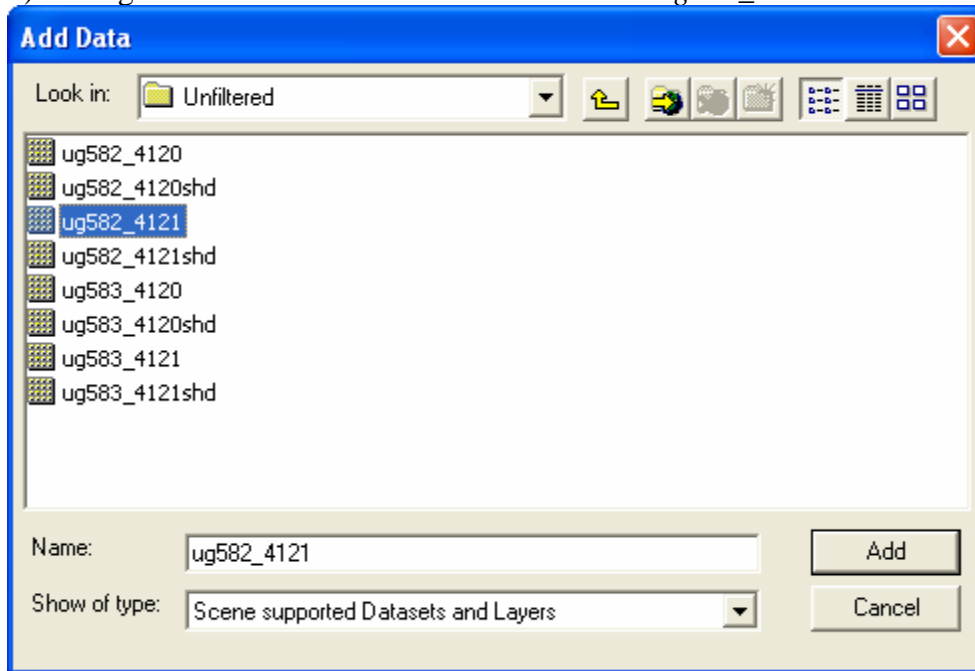
4) Right click on the *ug582_4121* Layer in the Table of Contents at left and choose
**Properties**.

5) Choose the **Base Heights** tab in the next screen. Click on the Obtain heights for
layer from surface: and navigate to find the same DEM as you had just loaded (it
is going to be "draped" on itself. Push **Apply**. Note that you can come back to this
screen and click on the **Raster Resolution** to change the resolution of the
resulting image if you want to sharpen it (but watch out for how much memory it
will cost you).
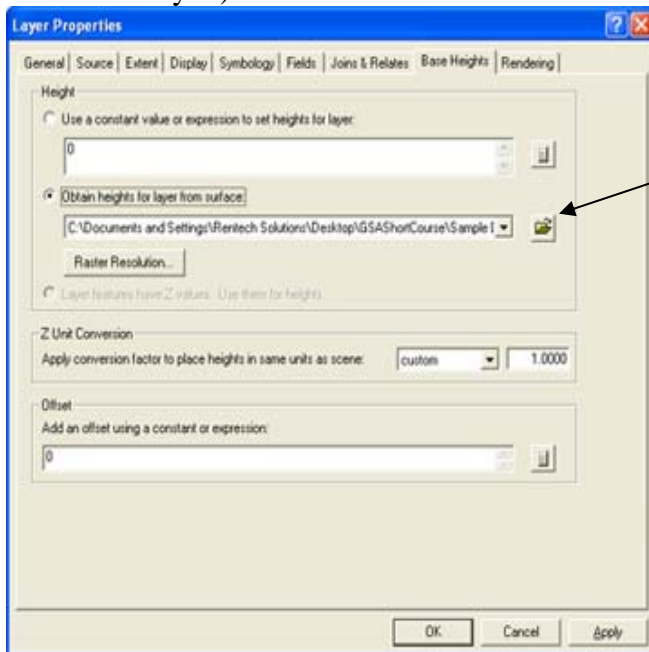
6) Choose the **Rendering** tab. Click on the **Shade areal features relative to the scene's light position**. Also, slide the bar for **Quality enhancement for raster images** all the way to the right to **High**. You may get a warning about the memory resources that this may require, but go ahead and try it. Push **Ok**.

7) Change the color of the surface. Right click on the *ug582_4121* Layer in the Table of Contents at left and choose **Properties**. Select the **Symbology** tab and change the color ramp to a greenish one.
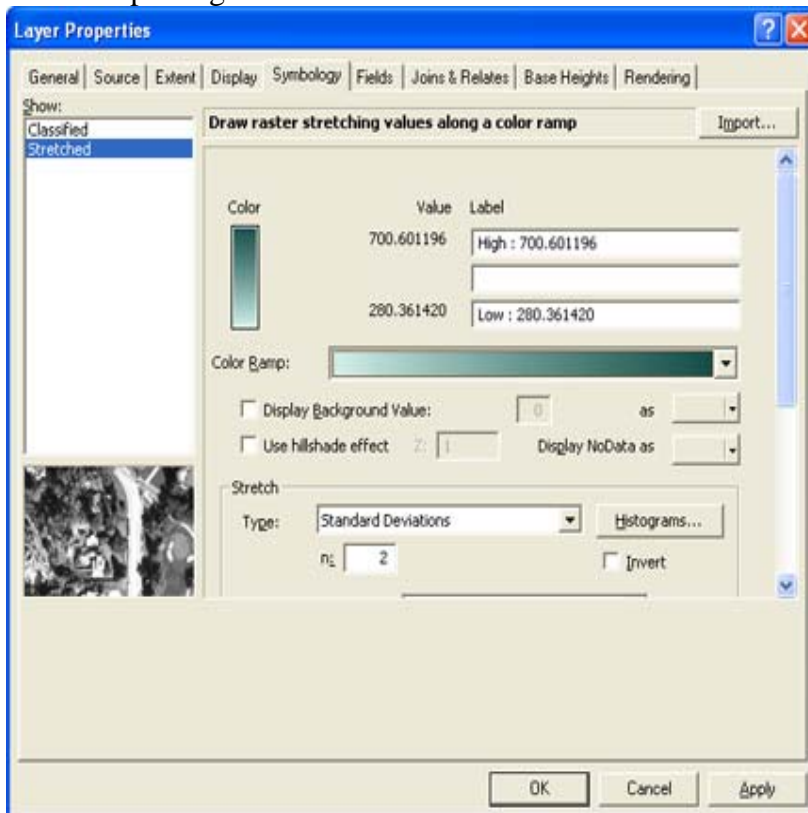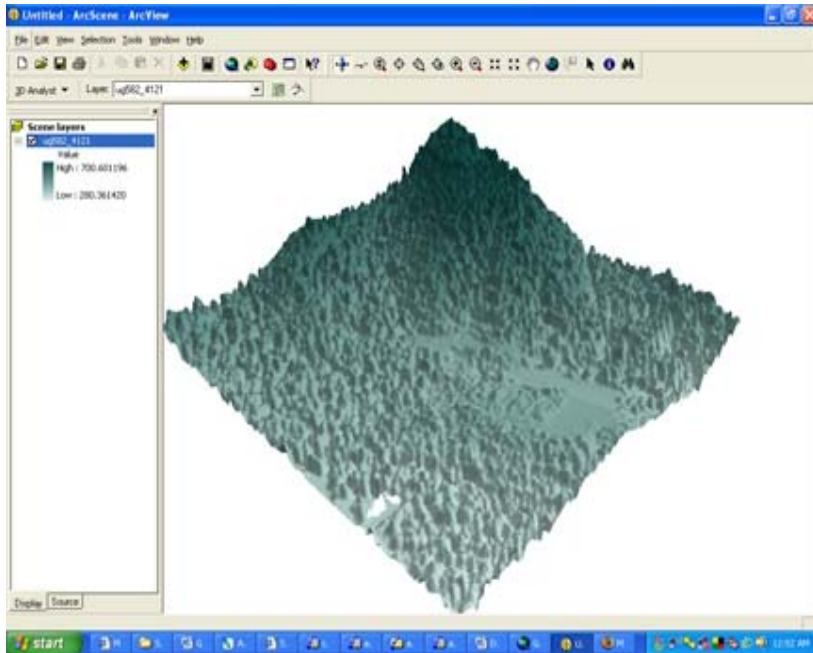
Repeat for the other files and try some other symbology.

8   The main navigation controls for ArcScene are in the menu bar at the top:

Spin   Zoom in and out   Pan   Zoom to the extent of
            interactively   the data