

# Modeling Data from the USGS Seamless Site

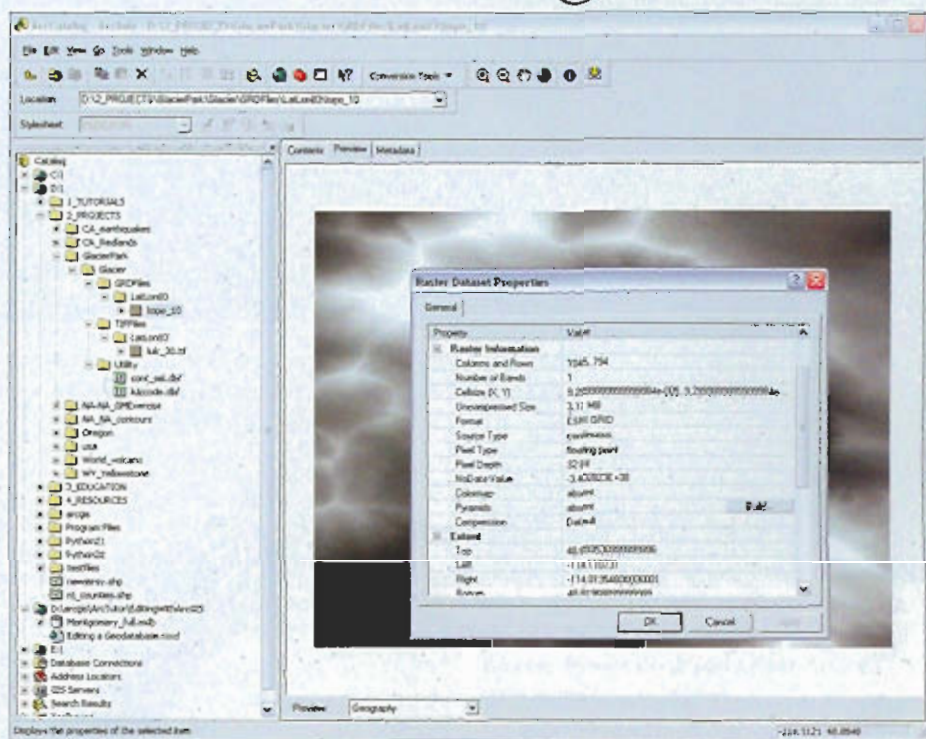
*Seamless.pdf*  
LINK  
GWS SITE

By Mike Price, Entrada/San Juan, Inc.

For many years, geographers modeled digital terrain of the United States using 7.5-minute digital elevation model (DEM) tiles downloaded from Internet sites or obtained on digital media. Modeling digital terrain with data available before 2000 was not always easy. Differences in resolution, elevation units, and boundaries sometimes made tiles problematic. Initially 30-meter (1 arc second) tiles were posted, followed by 10-meter (1/3 arc second) tiles in Universal Transverse Mercator (UTM) zones with North American Datum 1927. Although integer elevation units were typically meters, some 10-meter grids used feet. Merging adjacent tiles was often difficult, and tile boundary artifacts were often created. Some tiles also contained striated data that was very difficult to use for hydraulic, slope, and aspect modeling.

## The Seamless Data Distribution System

The U.S. Geological Survey (USGS) and the Earth Resources Observation & Science (EROS) Data Center recognized that a single, easily accessed data portal, hosting standardized terrain data, was necessary. In the late 1990s, USGS and EROS began transferring traditional 10- and 30-meter DEMs and other legacy data to commercial vendors. These agencies created a new Internet site for delivering seamless 10- and 30-meter data. The Seamless Data Distribution System (SDDS) ([seamless.usgs.gov](http://seamless.usgs.gov)) is the ultimate location for exploring and retrieving this type of data. USGS and EROS also provide online access to geospatial data



While previewing the sample data, right-click on *topo\_10*, the 10-meter DEM, and choose *Properties* to verify that this is a floating point grid in NAD83 decimal degrees.

through the *National Map* ([nmviewwgc.cr.usgs.gov/viewer.htm](http://nmviewwgc.cr.usgs.gov/viewer.htm)).

Along with digital terrain data, additional vector and raster format framework data is posted at this site including land-use/land-cover, orthoimagery, experimental high-resolution Light Detection and Ranging (LIDAR) data, transportation vectors, hydrography, and political boundaries. The many enhancements to this site are summarized in Table 1.

The data available on the site, arranged by framework type, includes places, structures, transportation, boundaries, hydrography, orthoimagery, land cover, and elevation. Downloading from SDDS can be challenging—limited Internet bandwidth, multiple users, pop-up blockers, a variety of destination system configurations—and can cause glitches that exhaust a user's patience. To help, the Seamless site includes a tutorial ([seamless.usgs.gov/tutorial.asp](http://seamless.usgs.gov/tutorial.asp)) on downloading data, information about the downloadable products, Frequently Asked Questions, and links to product pages.

	Tiled DEM Data	Seamless DEM Data
Download portal	Several commercial providers	Single site: <a href="http://seamless.usgs.gov">seamless.usgs.gov</a>
Resolution	30- and 10-meter	30-meter
Projection	Appropriate UTM zone	Decimal degrees
Datum	NAD27	NAD83
Elevation units	Integer meters and feet (for 10-meter DEM)	Floating point meters
Seaming	Individual tiles, not corrected along boundaries	Preseamed, corrected along boundaries
Data quality	Highly variable	Consistent
30-meter availability	Most of the continental U.S.	All continental U.S.
10-meter availability	Limited areas of the continental U.S.	Most of the continental U.S.

Table 1



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the green cell will display the number of degrees in a meter at the project latitude, and the blue cell will show the number of feet in a degree at the project latitude. Notice that these are very small numbers.

4. In ArcMap, place the cursor in the center of the project. Note the latitude in decimal degrees. It should be approximately 48.85 degrees.

5. In the spreadsheet, enter the latitude into the orange cell.

6. Select the green cell, and copy this value to the Windows clipboard by right-clicking and choosing Copy from the context menu.

7. Display ArcToolbox, and choose Spatial Analyst Tools > Surface toolset > Hillshade tool. In the tool wizard, select topo\_10 as the Input raster, name the Output raster %Glacier\GRDFiles\LatLon83\hsh\_10, and paste the value from the green cell in the Excel spreadsheet into the Z factor field. The Z factor is required, not optional. Click OK to build the hillshade. Place the hillshade above lule\_30 in the Table of Contents.

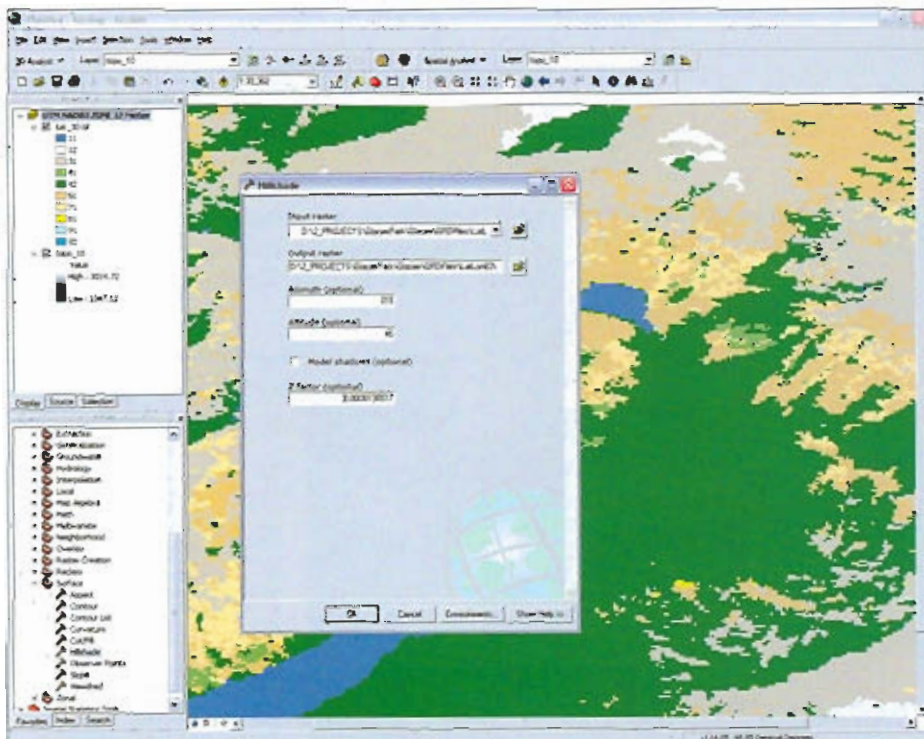
8. Right-click on the hillshade and choose Properties > Display, and set the hillshade transparency to 50 percent. Name the project Glacier01.mxd and save it.

## Deriving Slope in Percent

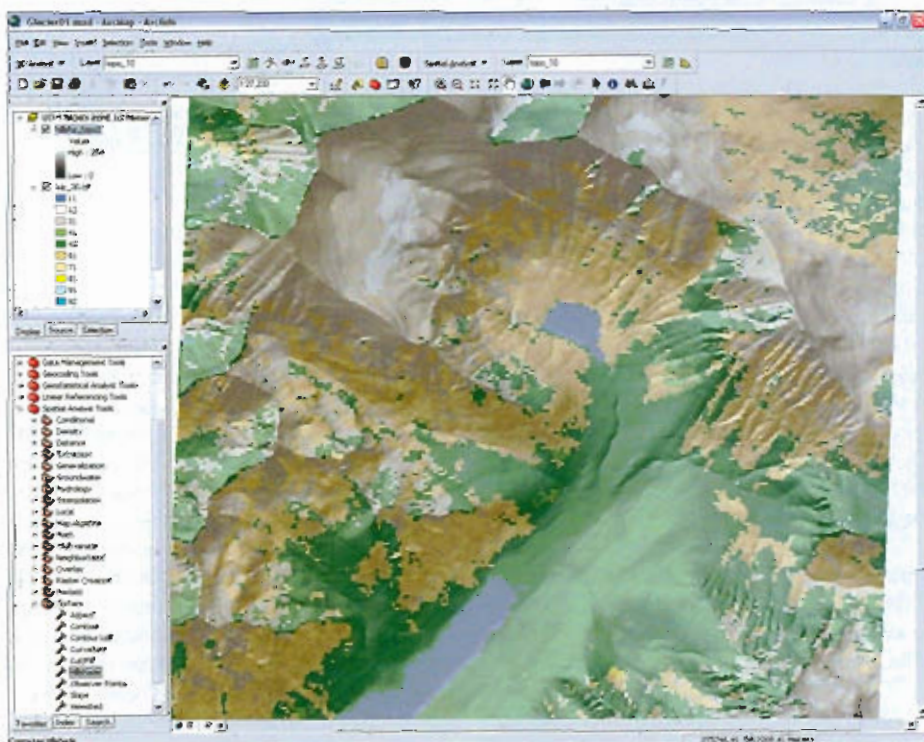
Now, use another tool in the ArcToolbox to calculate slope in percent. In the Spatial Analyst Surface toolset, select Slope. Fill the wizard using topo\_10 as the Input raster, name the Output raster %Glacier\GRDFiles\LatLon83\slpp\_10. The file name identifies the output as a slope in percent that was derived from a 10-meter DEM. Make sure to specify Percent\_Rise as the Output measurement. Don't forget

Break Points	Label Names
10	Under 10 Percent
20	10-20 Percent
30	20-30 Percent
40	30-40 Percent
50	40-50 Percent
100	50-100 Percent
200	100-200 Percent
400	More than 400 Percent

Figure 1: Break points and range labels



Use the Z factor calculated using the Excel spreadsheet when creating the hillshade for topo\_10.



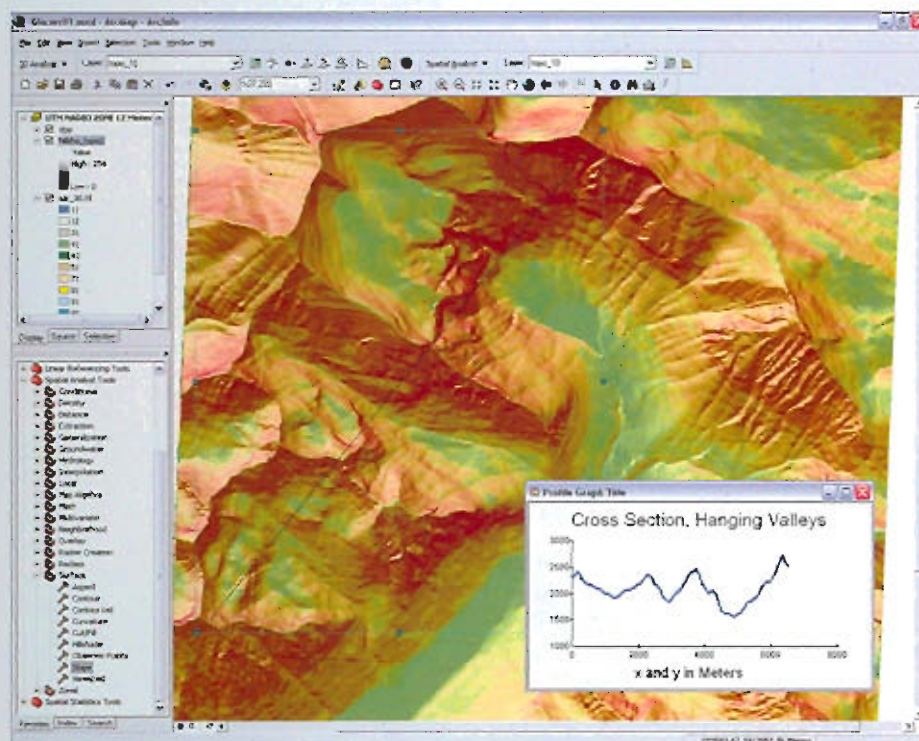
After creating the hillshade, set its transparency to 50 percent and place it above lule.tif.

to include the Z factor obtained from the spreadsheet. Click OK to derive the slope of this highly eroded terrain.

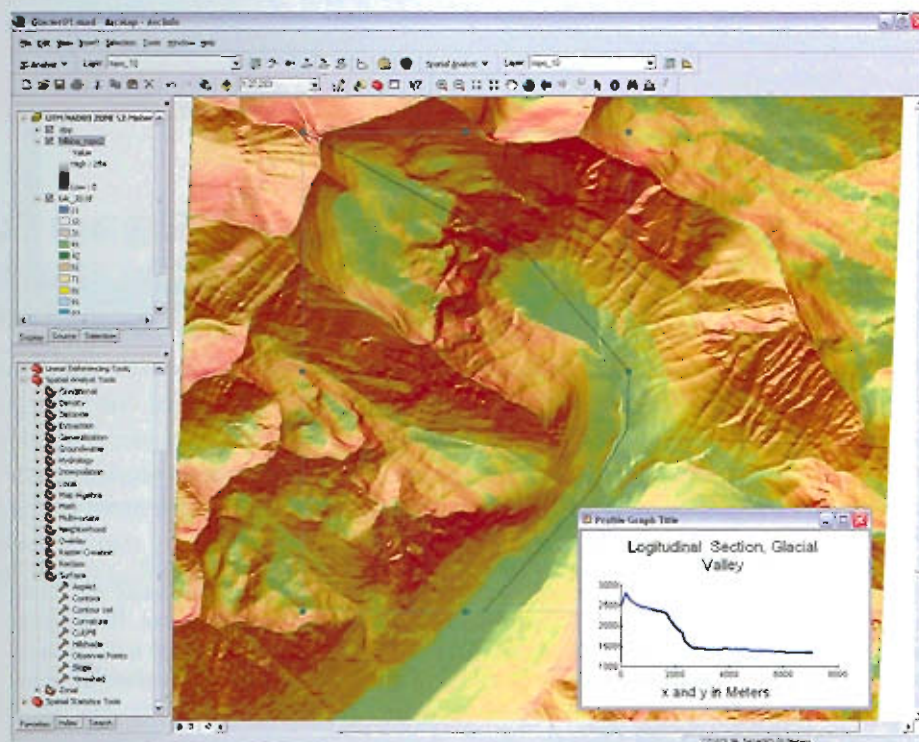
When the slope grid is completed, create a classified legend symbolizing slope in percent

using eight intervals. Right-click on the slpp\_10 layer, and choose Properties > Symbolization. Click on the Classify button, and set the break values as shown in Figure 1. Apply a green to red color ramp. Drag the slope percent layer

The Seamless Data Distribution System is the ultimate location for exploring and retrieving 10- and 30-meter DEM data.



After calculating the slope in percent, use the Interpolate Line tool to create a profile of some of the hanging valleys in this area.



Use the Interpolate Line tool to profile a glacier canyon longitudinally.

immediately below the partially transparent hillshade for a stunning look at this rugged glacier-carved topography. Save the project.

### Creating Profiles

The ArcGIS 3D Analyst extension includes powerful profiling tools that are available from the toolbar. Verify that the 3D Analyst extension is active and make its toolbar visible. Build a profile across several hanging valleys located on the upper left-hand side of the image.

1. Make topo\_30 active and locate the Interpolate Line tool by floating the cursor over the buttons on the 3D toolbar.
2. Click once in the southwest and again in the northeast to select the area for the cross section trace.
3. From the 3D Analyst toolbar, select the Create Profile Graph button to create a cross section.
4. Right-click on the profile window's title bar, and choose Properties to edit the graph's title and subtitle. Access the graph's Properties again, and choose Save. Save the graph (.grf) file to the same folder as the project. Other graph formatting options (such as changing the marker color) are available by clicking the Advanced button. Save the project.
5. Next, create a longitudinal section down the glacial valley by repeating the previous process but placing the trace line in an arc that starts at the north of the ridge that defines the glacial valley's highest limit at approximately 48.89 degrees.
6. Cross the ridge, head south, and follow the steepest path down the valley, clicking to set individual points along the valley that runs diagonally across the scene and double-clicking on the lake to end the profile.
7. Click the Create Profile Graph button to generate this profile. Modify the title and subtitle, and save the graph as previously described. Save the project again.

### Understanding and Mapping Land Use/Land Cover

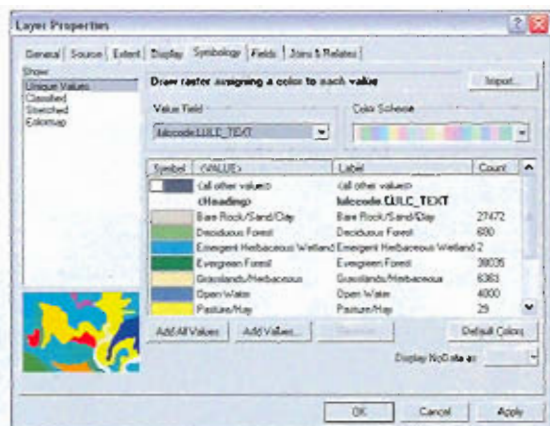
The 30-meter land-use/land-cover TIFF, lule.tif, contains many interesting colors that are associated with two-digit numbers. To create a meaningful LULC legend requires a lookup table that will supply the land-use/land-cover information denoted by the two-digit codes that will be used in the legend.

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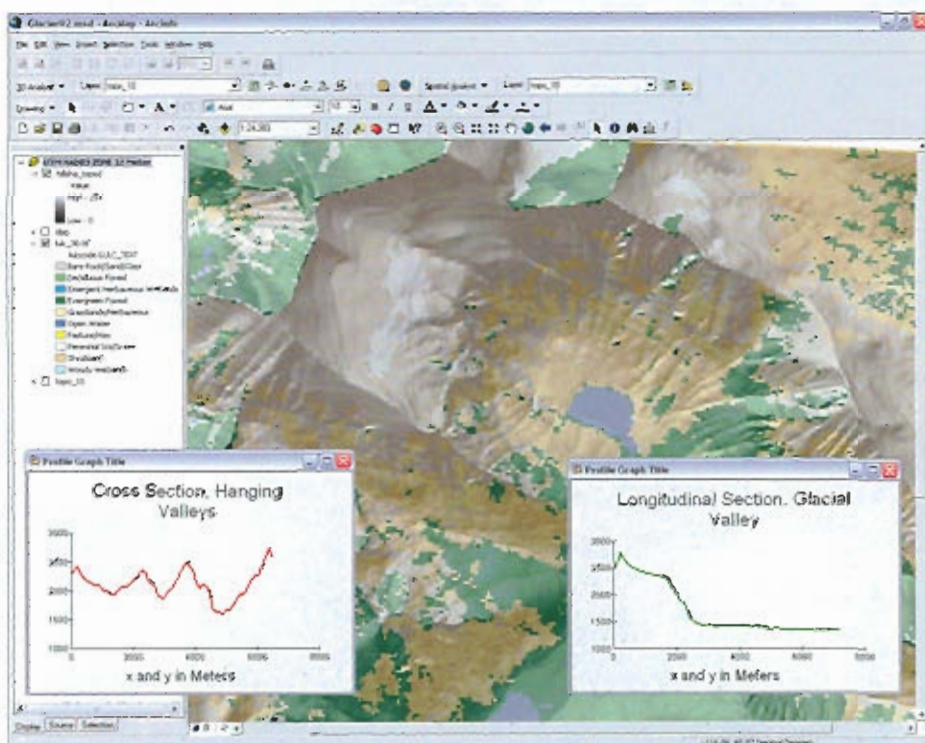
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1. In the Table of Contents, turn off the slpp\_10 layer to make the lulc\_30.tif layer visible.
2. Select the Add Data tool, and navigate to \GlacierUtility\. Select LULCCode.dbf and add it to the project.
3. Open the table and inspect it. Notice that it includes two important fields: LULC\_CODE and the descriptive LULC\_TEXT.
4. Join this table to lulc\_30 by right-clicking on lulc\_30 in the Table of Contents, and choose Joins and Relates > Join.
5. Base the join on the Value field, choose LULCCode as the table, and specify LULC\_Code as the field to use.
6. Right-click on lulc\_30 again, select Properties, and click the Symbology tab. On the Symbology tab, change the legend type from Colormap to Unique Values and specify lulccode.LULC\_TEXT as the Value Field. Colors remain the same because an RGB color scheme is already included in the Seamless LULC TIFF. Click OK.
7. Close the Layer Properties dialog box. Reload the two profiles by choosing Tools > Graphs > Load and selecting each graph file. Save the project again.



Join the DBF file containing the land-cover names to the lulc-tif attribute table.



Reload the profile graphs and admire this interesting landscape.

## Summary

This glacial terrain model depicts complex glacier-carved terrain on the edge of a conic projection. Take a moment to study it and observe steep valley walls, sharp ridges, and flat valley floors that comprise the extreme relief of a glaciated mountainous terrain. The input data and the derived hillshade and slope products are in geographic coordinates. The hillshade and slope were created using an appropriate Z conversion factor. ArcGIS displays these layers in UTM because appropriate coordinate metadata was supplied for each piece. As

the last step in this tutorial, visit the USGS Seamless site and download and model data for an area that interests you.

A companion article, "Virtual Geomorphology," takes the reader on a tour of the area used for this tutorial. Readers can consult the glossary of geology terms relating to glaciers for definitions of unfamiliar terms found on page 41.

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