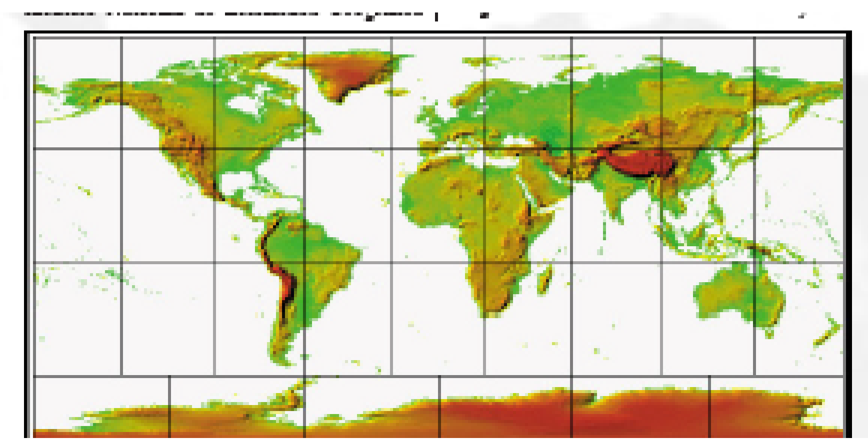
GEO 465/565 - Lab 7
Working with GTOPO30 Data in ArcGIS 9

This lab explains how work with a Global 30-Arc-Second (GTOPO30) digital elevation model (DEM) from the U.S. Geological Survey. This dataset can be converted to ESRI grid format using the ArcGIS Spatial Analyst extension. The data can be used with the ArcGIS 3D Analyst extension to create 2.5-dimensional surfaces (i.e., *looks* like 3-D). Images can be exported from these surfaces in formats suitable for use with other programs and on the Web.

Introduction

The data set to be used in this lab covers an area ranging between 90 degrees north to 90 degrees south latitude and between 180 degrees west to 180 degrees east longitude. The horizontal grid spacing is 30 arc-seconds (0.008333333 degrees or approximately 1 kilometer), resulting in a DEM with dimensions of 21,600 rows and 43,200 columns. The horizontal coordinate system is decimal degrees of latitude and longitude referenced to World Geodetic System Background on the GTOPO30 Data Set. The GTOPO30 data set was developed by the U.S. Geological Survey's EROS Data Center in 1996 with funding or data contributions from the National Aeronautics and Space Administration (NASA), the United Nations Environment Programme/Global Resource Information Database, the U.S. Agency for International Development, the Instituto Nacional de Estadistica Geografica

Choose the DEM data at the USGS EROS Data Center using the graphical interface.



e Informatica of Mexico, the Geographical Survey Institute of Japan, Manaaki Whenua Landcare Research of New Zealand, and the Scientific Committee on Antarctic Research. The GTOPO30 DEM raster dataset is derived primarily from the Digital Terrain Elevation Data (DTED) Level 1 data set produced by the National Imagery and Mapping

Originally developed by Lt. Keith P. Barto, United States Navy (*ArcUser* July-September 2000) with contributions from Dr. David Miller, SUNY College at Cortland, Gerry Hatcher, Monterey Bay Aquarium Research Institute, and Mike Price, ESRI. Updated for ArcGIS 9 by Paul Anderson and Colin Cooper, OSU Geosciences**.**

Agency (NIMA) and ESRI's Digital Chart of the World. of 1984 (WGS84). The vertical units represent elevation in meters above mean sea level. The elevation values range from -407 to 8,752 meters. Ocean areas have been masked as "no data" and have been assigned a value of -9999. Low-lying coastal areas have an elevation of at least 1 meter. If the ocean value is changed from -9999 to 0, the land boundary will be maintained. Due to the nature of the raster structure of the DEM, small islands in the ocean less than approximately 1 square kilometer are not represented. Information on available coverages and ordering procedures for this data can be found on the USGS Web site http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html.

Copying and Converting DEM Data

Copy the lab7_data folder to your student folder. (Distance ed students will need to download the zip file lab7_data.zip from Blackboard, and when unzipped should produce the folder GTOPO30.)

Launch ArcGIS (a new empty map) and make sure the ArcGIS Spatial Analyst and ArcGIS 3D Analyst extensions are checked on (recall from Lab 6 - TOOLS-EXTENSION-check the boxes).

Add the w100n40.bil file from lab7_data\GTOPO30. Select yes for creating pyramids. Click ok for projection message.

Open up ArcToolbox and expand Conversion Tools -> To raster -> and Raster to Other Format. In the dialogue box select w100n40.bil as your input file (from GTOPO30 folder) . Set the output workspace to your student folder\lab7_data\GTOPO30. Leave the Raster Format as GRID, and Click OK. It will take a minute or two to crunch the data.

Now add the layer you just created. It will be called W100n40 with no extension.

Open the attribute table for the W100n40 grid file (the file you just added) and notice how the values go from 1 to 6710 (meters) then jump to a value of 55,537 which is assigned to water. This high value needs to be changed for displaying properly and creating a hillshade from the grid.
Make sure your toolbars are displayed for 3D Analyst and Spatial Analyst (Go to View ->Toolbars -> and check 3D Analyst and Spatial Analyst). (Also, turn on the 3D Analyst extension, if necessary.)

To make the processing faster and learn how to select a subset of your raster data, resize the working area by using the drop down menu Spatial Analyst -> Options and click on the EXTENT tab. Change the Analysis extent to “as specified below” from the menu. In the As Specified Below screen fill in the Left to –100, Right to –95, Bottom to 35, and Top to 40. Click OK. The working area will now be located in the upper left corner of the view.

On the Spatial Analyst Toolbar, dropdown and select Reclassify. Make your W100n40 grid your input. In the Set Values to Reclassify box, click the Unique button. This will take a few moments (like half a minute) for the computer to build a list of single values. Once loaded, scroll down to the bottom to the Old Value 55537 and assign a **new value** of **zero**. Save the Output raster in your GTOPO30 folder, with a file name of Reclass. This step changes the range of values to a realistic spread. The reclassification takes about a 30 seconds. (You can change the symbology of your reclassified grid to a stretched color ramp if you would like)

Now turn off all layers except the new one called Reclass. We are now going to make a hillshade of the elevation data. Hillshade creates a shaded relief raster from a raster. The illumination source is considered to be at infinity. Go to 3D Analyst drop down menu -> Surface analysis -> hillshade. In the hillshade screen Set the input surface to Reclass, the Azimuth to 315 and the altitude to 55, the z factor to .004, and keep the default cell size. Save the output raster as hillshade in your GTOPO30 folder..

Create a map layout showing your reclass layer and your hillshade in separate data frames. You may also include a data frame showing the reclass draped on the hillshade. Be sure to include the standard cartographic elements.

Now we will display the data in 2.5-D.

1. Open ArcScene (there is an icon in arc map on the 3DAnalyst toolbar or you can look under programs ArcGIS ArcScene).
2. Add the recently created reclass and hillshade raster (Have reclass on top). Display the 3d effects tool bar View-> toolbars ->3D effects.
3. Change the color scheme of reclass from black and white to color. (you can use a “stretched” value color ramp in symbology)
4. Change the priority of the hillshade to low by clicking on the “Change depth priority” button  on the 3D effects tool bar. Lower the priority until the reclass is on top.
5. Make the reclass layer 20% transparent by clicking the “layer transparency” button  on the 3D effects tool bar (be sure to change the layers field in on the 3D effects tool bar to “reclass”)
6. The image will appear to be flat. You need to set the base height.Right click on the reclass and select -> Properties -> Base Heights. Make sure reclass is selected for the elevation values, by clicking the circle by the statement “obtain heights for layer from surface” and selecting reclass. Change the z value to .004.

7 Do the same thing for the hillshade layer, again using the reclass layer for the "obtain heights for layer from surface" and .004 as the z value.

8 Now set the Vertical Exaggeration by right clicking on the Scene Layer data frame (it has the icon of a little stack of yellow layers at the top of your table of contents) and clicking scene properties clicking the General tab. Change the Vertical Exaggeration to something less than one, or you can play with the values until you find the one that works the best for you by changing the value and clicking apply to see what it looks like.

Now you have a 3D-looking map. You need to find the best angle to view it from (you can change the angle by selecting the Navigate button  and clicking and dragging in the scene), and pick a color scheme that will show off the surface clearly. Export the final image as a JPEG by clicking on File→Export Scene→2D, and set the file type to jpeg.

3. Create an MS-Word document, and include answers to the following three questions:

    1) The DEM that you worked with in this lab has a resolution of 30 arc-seconds, which is approximately 1 kilometer. Other DEMs that are readily available for use have higher resolutions, usually 30 meters or 10 meters. Explain what this means.

    2) For what type of analysis would a 30 arc-second DEM be appropriate? What are the advantages and disadvantages of working with such a coarse resolution?

    3) For what type of analysis would a higher-resolution DEM be appropriate? What are the advantages and disadvantages of working with high resolution data?

TURN IN FOR LAB 7:

Your answers to the 3 questions

ArcMap layout

2.5D graphic from ArcScene

Do not submit screen shots, everything is to be exported as a JPEG. DO show a caption and a scale bar for each data frame on the layout, a legend, a north arrow, and the title of your layout (this must describe what the layout is showing clearly). Also include a neatline around the whole layout, and your name.