

ArcGIS® ArcMap™

10.3.1

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**Working with
Digital Elevation Models
and
Spot Heights in ArcMap
10.3.1**

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INTRODUCTION

This documentation outlines the steps needed to work with Spot Heights and Digital Elevation Models (DEM) in ArcMap from the following providers.

1. Spot height data from NRVIS, the City of Kitchener, and the City of Toronto
2. Spot height data from DMTI and GRCA
3. DEM data from NRVIS
4. DEM data from DMTI, GTOPO30, GLOBE, and NRCan CDED

The data from these sources come in a variety of formats, some requiring more pre-processing than others. Steps will be provided so that the user can load the required dataset into ArcMap and perform some basic visualization. At the end of each set of instructions an example screen shot will illustrate what the output would generally resemble (screen shots will vary based on spatial extent, dataset provider and the interpolation method used).

For the purpose of this tutorial the term “Spot heights” refers to the datasets which contain a myriad of points with an associated elevation or z-value. The term DEM will be applied to those datasets which originate as continuous surfaces.

WORKING WITH SPOT HEIGHTS FROM NRVIS, CITY OF KITCHENER, AND CITY OF TORONTO

Converting from Spot Height points (.shp) to a Raster (ESRI GRID) in ArcMap

1. Begin by adding the DEM to the map window. Click on **File**→**Add Data** and select the appropriate .shp or .dwg file
2. Turn on the **3D Analyst** extension from the **Customize**→**Extensions** menu by checking the appropriate box
3. **Close** the extensions dialogue
4. From the **Geoprocessing**→**ArcToolbox** menu click on **3D Analyst Tools**
5. Click **Raster Interpolation** and choose the interpolation method that best suits the dataset.

Note:

From this menu there are 4 ways to change the spot height points into a DEM raster: Inverse Distance Weighted (IDW), Kriging, Natural Neighbor, and Spline. ArcMap Help contains detailed help on each method (<http://pro.arcgis.com/en/pro-app/tool-reference/3d-analyst/comparing-interpolation-methods.htm>)

6. Each method requires **Input Points** which is the point shapefile (Spot Heights) currently displayed, along with **Z-Values** which is the attribute that contains the heights of each point. Some common attribute names containing height values are Height, Spot, and Elev.
7. Specify the name of the output file by changing the filename of the **Output Raster** field
8. Click on **OK** and the program will generate a ESRI GRID from the spot height points

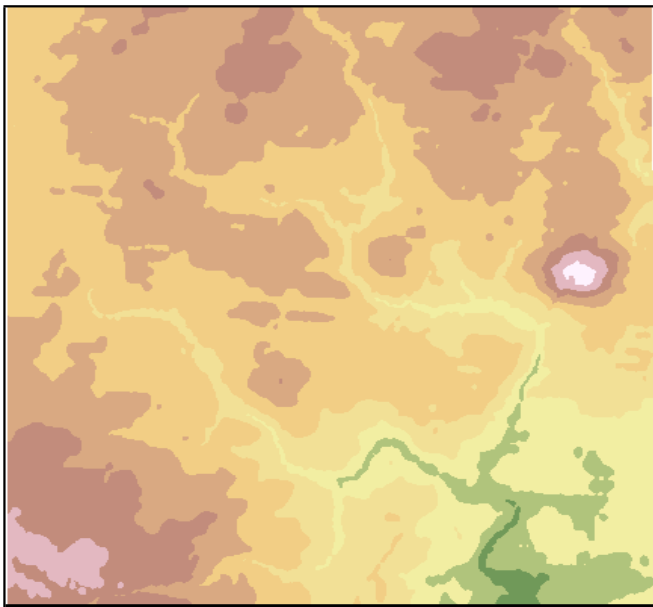


Figure 1: Converting to a GRID (Kriging – NRVISDataset)

Converting from Spot Heights (shp) to Triangulated Irregular Network (TIN) in ArcMap

1. Begin by adding the point file to the map window. Click on **File**→**Add Data** and select the appropriate .shp or .dwg file.
2. Turn on the 3D Analyst extension from the **Customize**→**Extensions** menu by checking the appropriate box.
3. Close the extensions dialogue.
4. From the **Geoprocessing**→**ArcToolbox** menu click on 3D Analyst Tools.
5. Click on **Data Management**→**TIN** and choose Create **TIN**.
6. For the **Input Feature Class** specify the spot height shapefile by selecting it from the dropdown box.
7. Set the **Height Source** to the attribute value that contains the elevation data. Some common attribute names containing height values are Height, Spot, and Elev.
Note: The TIN creation process does not interpolate points; it merely connects adjacent points together in a triangular network. Therefore, more points lead to a better surface model
8. Specify the name of the output file by changing the filename of the **Output TIN** field.
9. Click on OK and the program will generate a TIN from the spot height points.

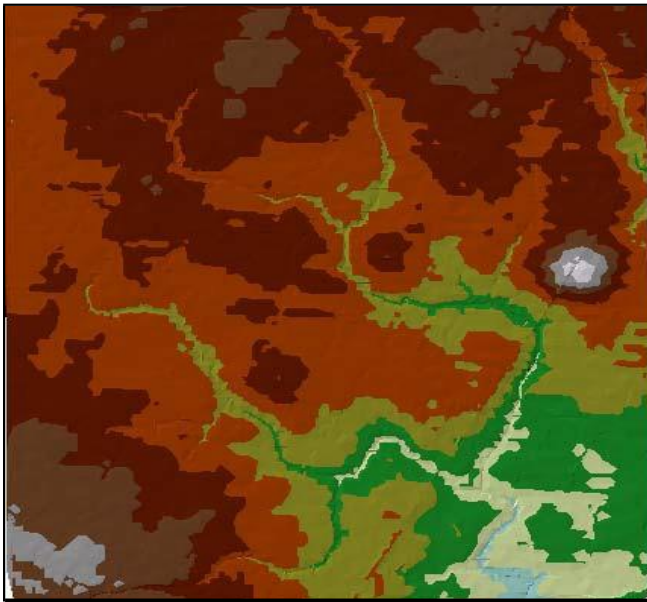


Figure 2: Converting to TIN (NRVIS Dataset)

*Tip: Once you have created a surface, whether it is a GRID or TIN, you can perform a number of different types of analyses using the surface analyst tools such as contours, slope, aspect, and hillshade. These tools can be found on the **3D Analyst Tools** in the ArcToolbox.*

WORKING WITH ASCII DEMS FROM DMTI AND GRCA

Importing ASCII DEM (*.asc or *.txt) to ArcMap (ArcMap can read directly from .asc files but not .txt files)

1. Open ArcMap and navigate to the **Geoprocessing** menu and select ArcToolbox. This, by default, will open a window beside the layer window.
2. In the **ArcToolbox** window select **Conversion Tools**→**To Raster** and select ASCII to Raster.
3. Specify the **Input ASCII raster file** field as the name of the dataset including the .asc file extension.
4. Specify the **Output raster** field to the path and filename where you would like to the new DEM stored and click OK.
5. This will convert the DEM from an ASCII text file into an ESRI GRID format.

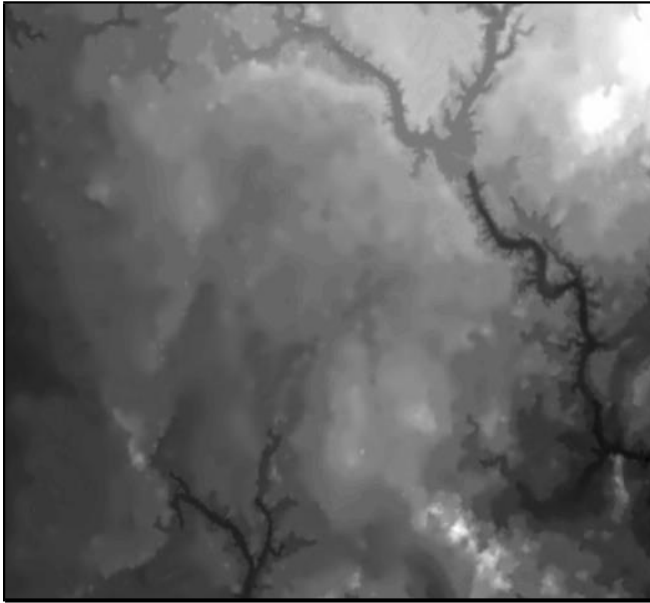


Figure 3: Importing from an ASCII File (DMTI dataset)

*Tip: You can change the colour values of the raster to better represent a real landscape by right-clicking on the layer name and selecting **Properties**. Click on Symbology and change the Colour Ramp to the desired scheme*

WORKING WITH DIGITAL ELEVATION MODEL (DEM) DATA FROM GLOBE

Note: GLOBE [<http://www.ngdc.noaa.gov/mgg/topo/globe.html>] is also a global digital elevation model (DEM) with a 1 kilometer resolution. This project was headed by the Committee on Earth Observation Satellites. Actually it is <http://www.ngdc.noaa.gov/mgg/topo/glfiles.html>

Importing GLOBE DEM (Band Interleaved Raster) into ArcMap

1. Download the dataset or desired tiles from [ngdc.noaa.gov/mgg/topo/glfiles.html](http://www.ngdc.noaa.gov/mgg/topo/glfiles.html).
2. In Windows Explorer navigate to the directory which contains the downloaded file (.zip or .gz)
3. Extract the file (Windows can extract .zip files [right-click, select "Extract All"])
4. The resultant file's extension needs to be renamed to .bil (band interleaved format) in order to be viewed in ArcMap. This can be done by right-clicking on the filename and selecting Rename. Change the three character file extension from .dem to .bil.
5. Download the corresponding header file from [ngdc.noaa.gov/mgg/topo/elev/esri/arcgis/](http://www.ngdc.noaa.gov/mgg/topo/elev/esri/arcgis/) and place it in the same directory as the .bil file (step 4). ArcMap can now open the tile.
6. Although ArcMap will now open the dataset, it still lacks a spatial reference. To project the dataset, in the **ArcToolbox** window, select **Data Management**→**Projections and Transformations** and select Define Projection.
7. Specify the .bil file as the **Input Dataset** field entry.
8. Specify the Coordinate System as **Geographic Coordinate Systems**→**World** and select WGS 1984. (spatial definition: 'Geographic', 'DD', 'WGS 1984')

Commented [CD1LG1]: <http://www.ngdc.noaa.gov/mgg/topo/report/s11/s11Gxii.html> (globe provided arcmap import guide)

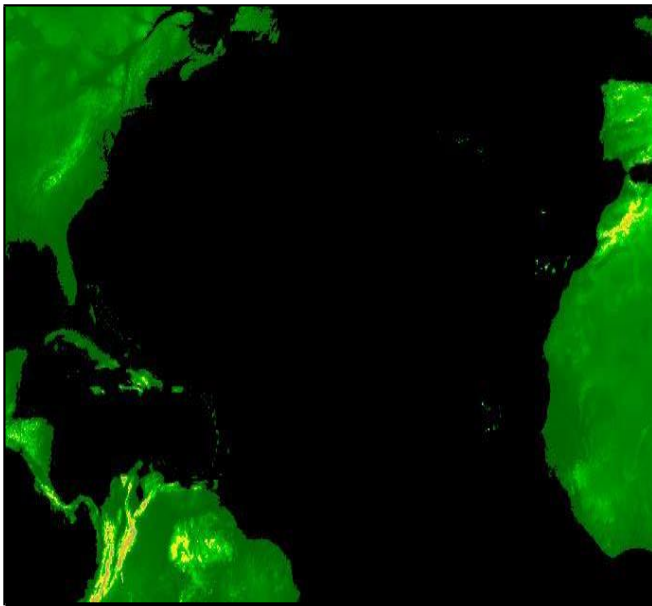


Figure 4: Importing from a band interleaved format (GLOBE Dataset)

WORKING WITH DIGITAL ELEVATION MODEL (DEM) DATA FROM NRCAN CDED

File Format: USGS DEM *.dem

Importing USGS DEM into ArcMap

1. Open ArcMap and navigate to the **Window** menu and select ArcToolbox. This, by default, will open a window beside the layer window.
2. In the **ArcToolbox** window select **Conversion Tools**→**To Raster** and select DEM to Raster.
3. Specify the **Input USGS DEM file** field as the name of the dataset.
4. Specify the **Output raster** field to the path and filename where you would like to the new DEM stored and click OK.
5. This will import the DEM data from a USGS DEM format into an ESRI GRID format.

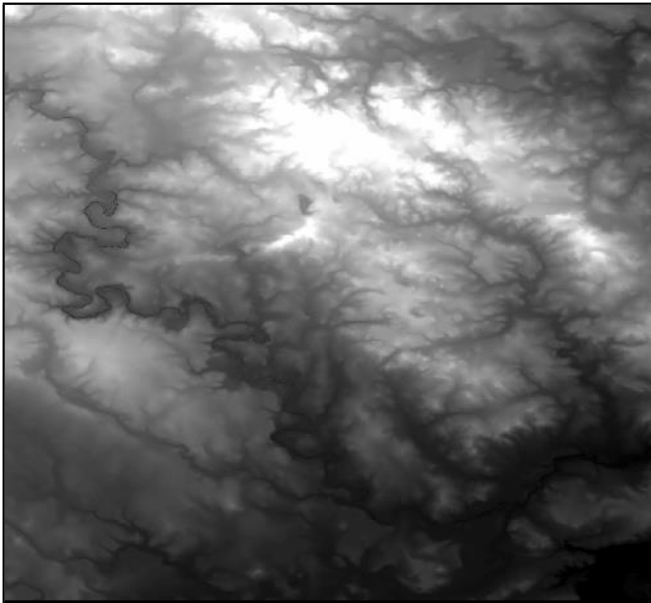


Figure 5: Importing from a USGS DEM format (CDED Dataset)

*Tip: Try using the Hillshade tool located under **3D Analyst Tools**→**Raster Surface** in order to greater emphasize the relief*

3D VISUALIZATION USING DIGITAL ELEVATION MODEL (DEM) DATA

3D Visualization Using ArcScene

1. Open ArcScene and add an elevation raster to the layer list.
2. Right-click on the layer and select **Properties**.
3. From the **Properties** dialogue select the **Base Heights** tab and click on the **Floating on a custom surface** radio button. (dataset must be continuous)
4. Set the value of this field to the dataset in the layer list and click **OK**.
5. Right-click on **Scene layers** and select **Scene Properties**.
6. From the **Scene Properties** dialogue select the **General** tab.
7. Use the dropdown box to select a predefined **Vertical Exaggeration** or specify a user defined value and click **OK**.
8. Use the various tools on the toolbar to navigate around the newly created 3D surface.

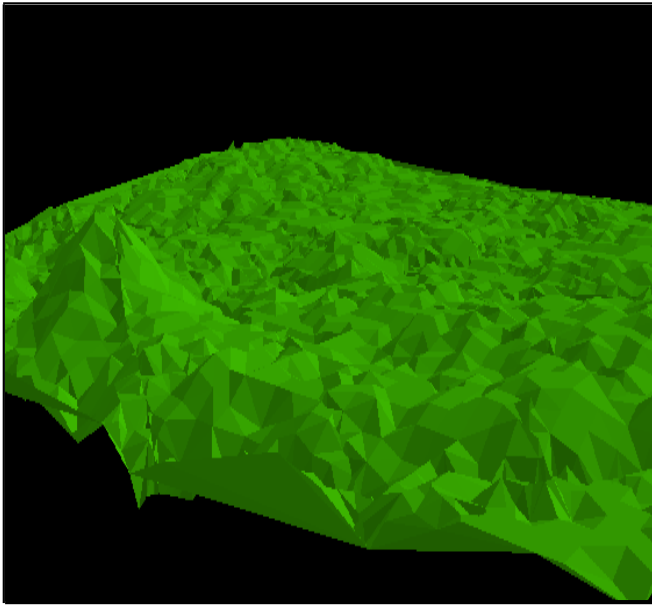


Figure 6: 3D Visualization using a TIN derived from NRVIS Spot Heights (NRVIS Dataset)

*Tip: Try adding layers such as rivers, roads, or lakes ovetop of the surface. Once the layers are added right click on the desired layer and select **Properties**. From the **Properties** dialogue select the **Base Heights** tab and click on the **Floating on a custom surface** radio button*

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June 2005
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