

GIS Procedural Guide

Finding, Converting and Mosaicking DEMs in ArcGIS 9.2+

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Introduction

This guide contains information on the following Digital Elevation Model (DEM) topics:

- 1 – Finding the Right DEM data for your project
- 2 – Converting DEM data for use in ArcGIS
- 3 – Merge/mosaic multiple DEMs

Part 1 – Finding the Right DEM Data for your Project

The most suitable DEM data for your project largely depends on the geographic size of your area of interest and the level of detail necessary for your analysis. For a project concerning a small geographic area, like an urban area or a sub-watershed, the highest resolution data available should be considered. Coarser resolutions are normally suitable for large area analyses (regional, provincial, or countrywide studies, etc.).

The following are examples of frequently used DEM datasets available at the Map Library or for free download via the web:

Ontario DEM Version 2.0

Ontario Ministry of Natural Resources

This is a tiled DEM dataset of 10m resolution data for Southern Ontario and 20m resolution for Northern Ontario. This data is available to UWO community members only and is made available from the Map Library or the Social Science Data Resources Library. For more details, see http://geography.uwo.ca/maplibrary/geospatial/mnrdeems_2005_data.htm.

Canadian Digital Elevation Data (CDED)

Natural Resources Canada

CDED is a free tiled DEM dataset based on the 1:50,000 and 1:250,000 National Topographic System (NTS). The dataset covers the entire Canadian landmass. Depending on the latitude of the CDED section, the grid spacing, based on geographic coordinates, vary in resolution from a minimum of 0.75 arc seconds (approximately 20m) to a maximum 3 arc seconds (approximately 90m) for the 1:50,000 NTS tiles, and from a minimum of 3 arc seconds to a maximum 12 arc seconds for the 1:250,000 NTS tiles respectively. CDED DEM data is available for free download via Geobase at <http://www.geobase.ca/>.

Shuttle Radar Topography Mission (SRTM)

NASA

SRTM is a 90m DEM dataset, covering over 80 per cent of the Earth's land surface, including everything between 60 degrees North and 56 degrees South latitude. Void filled data can be downloaded freely via <http://srtm.csi.cgiar.org/>.

GTOPO30

USGS

GTOPO30 is a 30 arc second (approximately 1km) resolution data for most of the world. This data can be freely downloaded from USGS at <http://edc.usgs.gov/products/elevation/gtopo30/gtopo30.html>.

Part 2 - Converting DEM data for use in ArcGIS

Usually DEMs that you can acquire from UWO or the internet are pre-formatted to work with ArcGIS 9; however, some types will need to be converted to a raster GRID format before

they can be viewed and used in ArcMap. ArcGIS contains a number of conversion tools that will work with DEMs. Two common conversion examples are listed below.

If you are not sure what format your DEM is in (ie. you cannot see the extension of the file), open My Computer, click View and uncheck the box which says "Hide file extensions for known file types".

Binary Float to Raster

The input file is an IEEE floating-point format, 32-bit signed binary file. This is the native file format for the frequently used 10 metre resolution Ontario DEM version 2.0 files, obtainable at UWO. To properly convert the file, you need to have two files with the same name in the same folder: the binary floating-point file with a .flt extension (anyname.flt) and a header file with a .hdr extension (anyname.hdr).

To undertake the conversion, open either ArcMap or ArcCatalog and expand the ArcToolbox.

Select Conversion Tools ► To Raster ► Float to Raster.



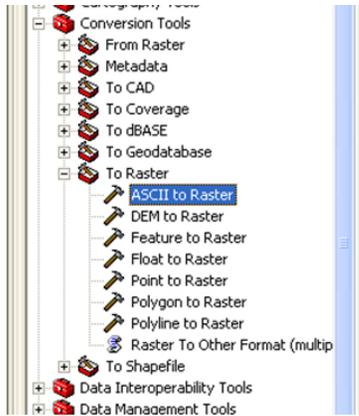
Make sure to select your float file as the "Input floating point raster file" and give the Output file an appropriate name. Click OK. The conversion tool will automatically output an ESRI GRID format raster that can now be used in ArcMap.

ASCII Text to Raster

The ASCII file format is a simple format used for transferring raster data from one application to another. Many different GIS programs can import this type of file, which can have either a text (.txt) extension or an ASCII (.asc) extension. The ASCII file must consist of header information containing a set of keywords, followed by cell values in row-major order. You can check to see if your file has this information by opening the file with Windows Notepad. The file format is:

```
<NROWS xxx>
<NROWS xxx>
<XLLCENTER xxx | XLLCORNER xxx>
<YLLCENTER xxx | YLLCORNER xxx>
<CELLSIZE xxx>
{NODATA_VALUE xxx}
row 1
row 2
...
row n
```

To undertake the conversion, open either ArcMap or ArcCatalog and expand the ArcToolbox. Select Conversion Tools ► To Raster ► ASCII to Raster.

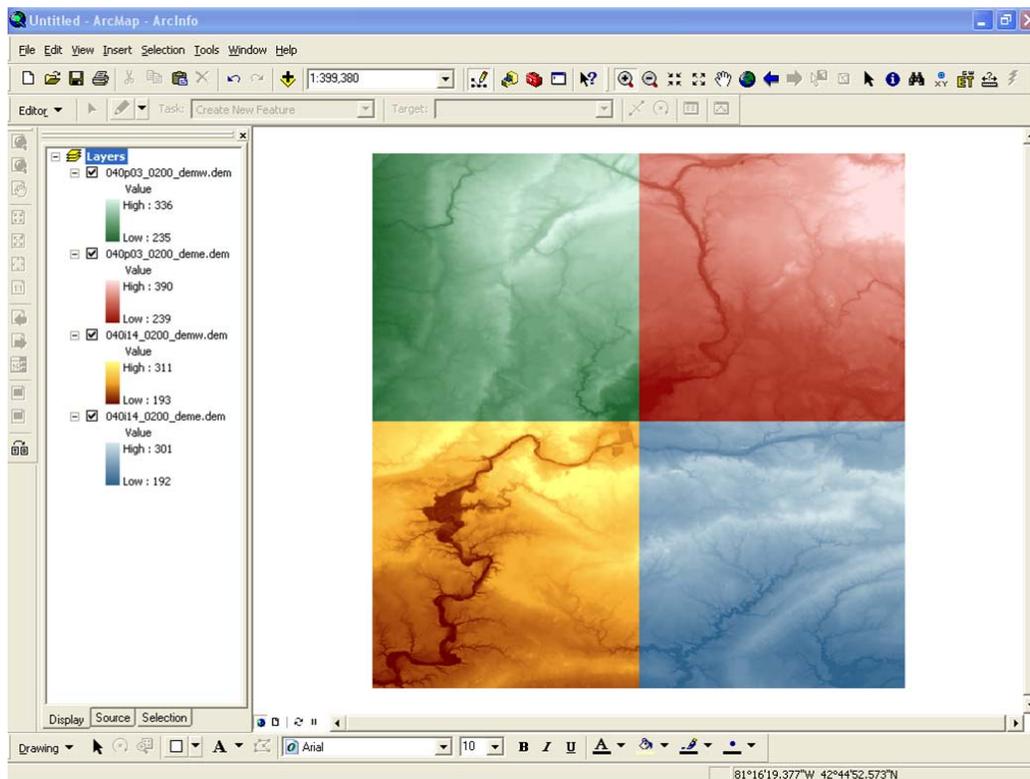


Make sure to select your ASCII file as the “Input ASCII raster file” and give the Output file an appropriate name. The output data type can be INTEGER (no decimal places) or FLOAT (decimal places). Click OK. The conversion tool will automatically output an ESRI GRID format raster that can now be used in ArcMap.

Part 3 – Merge/Mosaic Multiple Rasters

Higher resolution DEMs are usually stored as tiled datasets. If your DEM tiles are adjacent and have the same cell resolution and coordinate system (ie. from the same source), it may be beneficial to merge the tiles together to form one DEM. A single DEM will draw faster in ArcGIS and will be better suited for any geoprocessing or analysis tasks you may need to undertake.

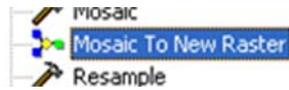
Open ArcMap and add some adjacent DEMs. As an example of suitable candidates for a mosaic operation, the following graphic shows four adjacent CDED DEMs for the area around London, Ontario (ramps have been changed for illustration purposes).



Two methods of merging/mosaicking rasters are described below.

Method 1: Mosaic to New Raster

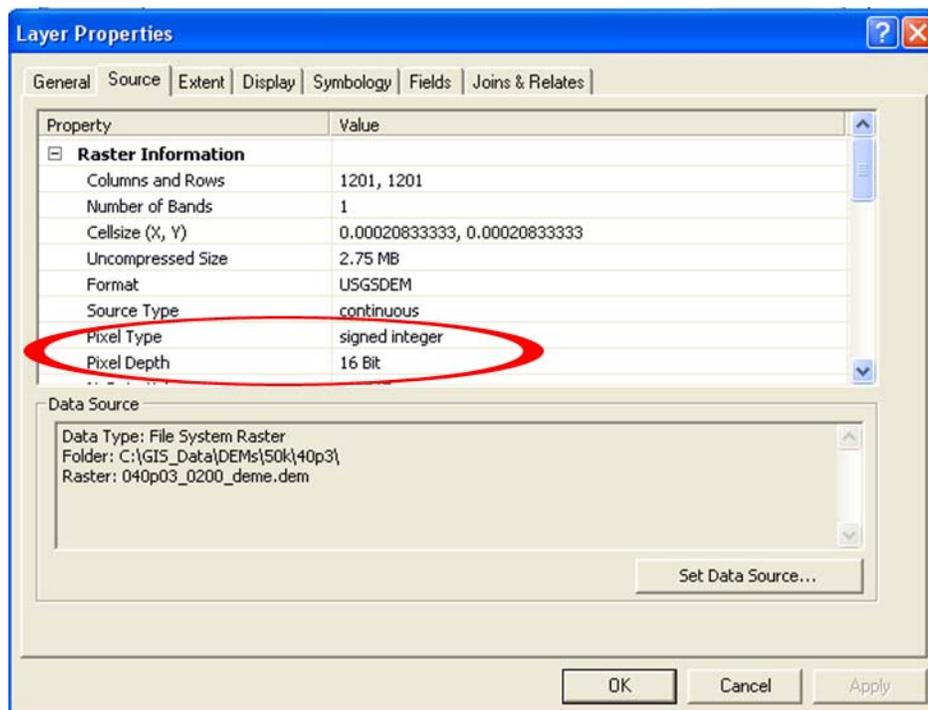
Open ArcToolbox and select the Data Management ► Raster ► Mosaic to New Raster model.



If models are new to you, you should note that a model simply consists of one process or a sequence of processes connected together, where the output of one process becomes the input for another. Models can be run from a dialog box, and behave just like any tool. This model is a simple combination of several tools, designed to create a new raster dataset and mosaic the list of input rasters to it.

In the Mosaic to New Raster model dialog box, input your adjacent DEM rasters that you would like to mosaic. Make sure to select an Output Location (the folder in which you would like to store your newly mosaicked raster) and give it an appropriate name. You can also give your file name an extension depending on which file format you prefer (TIFF, JPEG2000, etc.) or you can simply leave out the extension, resulting in an ArcGRID format.

Most of the other parameters can be left as the default, but for this example we will change the Pixel Type to match our input DEMs. To check the pixel type of one of your source DEMs, double click on its name in the ArcMap table of contents to bring up the Layer Properties window. Select the Source tab and take note of the information beside Pixel Type and Pixel Depth.

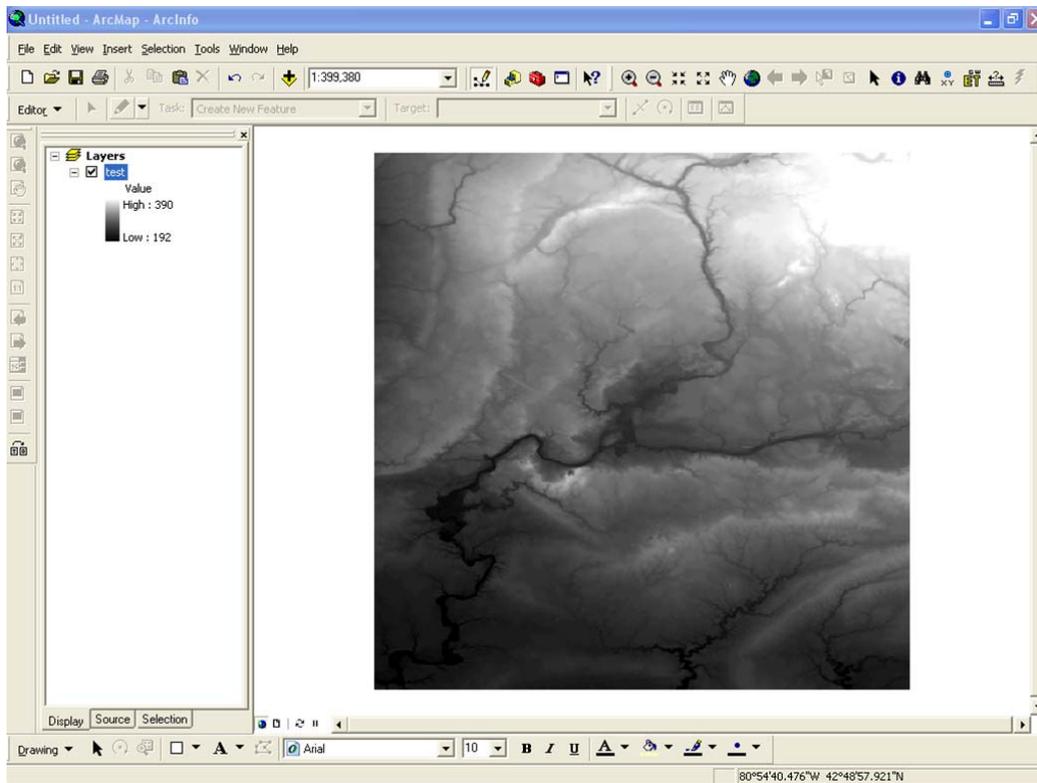


For our London area CDED DEMs, the pixel type is SIGNED INTEGER and the pixel depth is 16 BIT. Back in the Mosaic to New Raster model dialog box, we can now set the Pixel Type to 16_BIT_SIGNED. Click OK to run the model.

Your new raster should be automatically added to your ArcMap display. If it appears very dark or washed out in grey, you should try setting the Stretch type to something more

suitable. Double click on the layer name in the table of contents to bring up the Layer Properties window and in the Symbology tab, set the Stretch type to Standard Deviations.

The following graphic shows an example of the mosaicked raster, created from the four London area CDED DEMs:

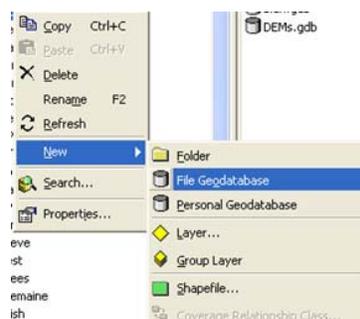


Method 2: Create a Raster Dataset in a File Geodatabase

When creating a raster dataset from multiple rasters, the data is mosaicked, or aggregated, into a single, seamless dataset and any areas of overlap are removed. The input rasters must be adjacent and have the same coordinate system, cell size, and data format.

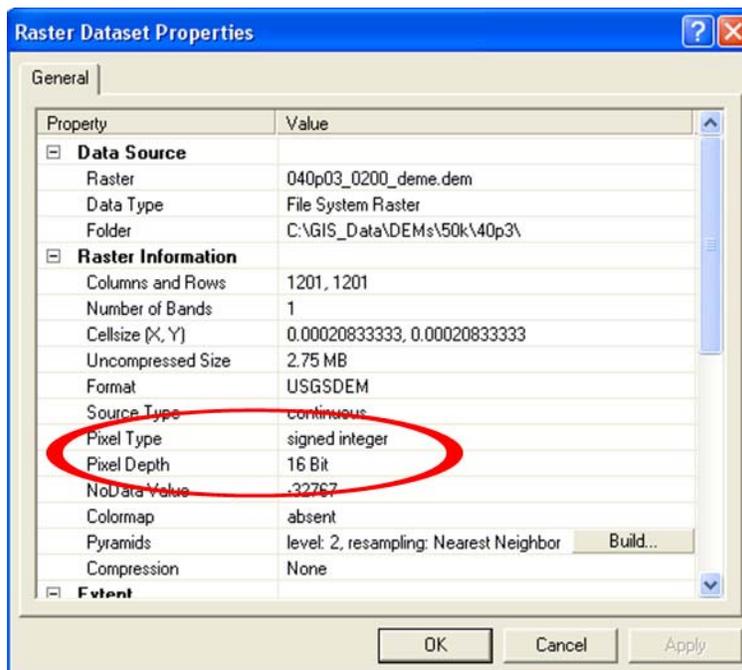
Raster datasets are referenced by the geodatabase. This means the individual raster data files that were mosaicked to create the raster dataset are fully controlled by the geodatabase. If the geodatabase is moved to another location, the individual raster files move with it.

If you need to create a new File Geodatabase, Open ArcCatalog and use the Catalog tree to navigate to a folder that you would like to store your geodatabase (you can right click to create a new folder if necessary). Right click on the folder and select New ► File Geodatabase and give it an appropriate name.



Now, right click on your new File Geodatabase, and select New ► Raster Dataset. In the Create Raster Dataset window, make sure to give your new raster dataset an appropriate name. You can also give your file name an extension depending on which file format you prefer (TIFF, JPEG2000, etc.) or you can simply leave out the extension, resulting in an ArcGRID format.

Most of the other parameters can be left as the default, but we will change the Pixel Type to match the input DEMs that we will eventually load. To check the pixel type of one of your source DEMs, double click on its name in the ArcCatalog table of contents to bring up the Raster Dataset Properties window. Select the Source tab and take note of the information beside Pixel Type and Pixel Depth.



For our CDED DEMs, the pixel type is SIGNED INTEGER and the pixel depth is 16 BIT. Back in the Mosaic to New Raster model dialog box, we can now set the Pixel Type to 16_BIT_SIGNED. Click OK.

Now click the plus sign beside your File Geodatabase name to expand it. Right click on your Raster Dataset and select Load ► Load Data.... In the Mosaic window, add all the DEMs you would like to add to your Raster Dataset. You can leave the rest as the default. Click OK.

Open ArcMap and add the Raster Dataset to your display. If it appears very dark, or washed out in grey, you should try setting the Stretch type to something more suitable. Double click on the layer name in the table of contents to bring up the Layer Properties window and in the Symbology tab, set the Stretch type to Standard Deviations.