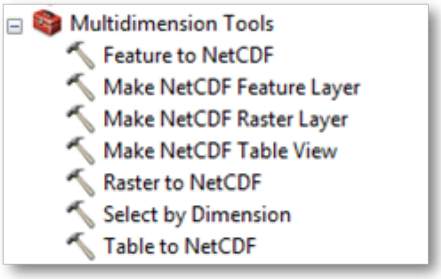
Use ORNL DAAC TDS Data Resources in ArcGIS

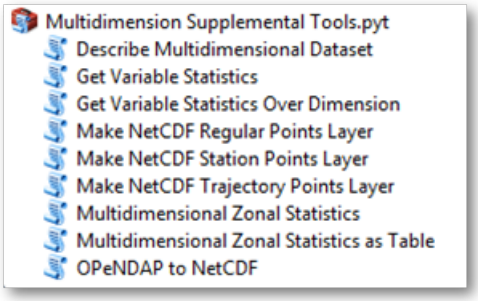
1. ArcGIS and Toolboxes used in this Tutorial

ArcGIS Desktop
ArcGIS Desktop 10.1.x or ArcGIS Desktop 10.2.x

Multidimension Tools
The Multidimension toolbox contains tools that operate on netCDF data. You can use these tools to make a netCDF raster layer, feature layer, or table view; to convert to netCDF from a raster, feature, or table; and to select a dimension of a netCDF layer or table.



Multidimension Supplemental Tools v1.2
[*http://www.arcgis.com/home/item.html?id=9f963f362fe5417f87d44618796db938*]
The Multidimension Supplemental toolbox Version 1.2 is a collection of nine tools which extend the functionality of the core tools of the Multidimension toolbox. These tools can be used as-is or you can modify them to handle specific use cases.



2. Usage Example

In this example, we will use ArcGIS to retrieve part (2013-01-01 and conterminous U.S.) of the *2013 daily maximum temperature* data from the remote ORNL DAAC THREDDS data server, trim the retrieved data to exactly fit the conterminous U.S. boundary, and then map the data with an elevation background map provided by ESRI.

Find data of your interest in ORNL DAAC THREDDS data server

Go to http://thredds.daac.ornl.gov/thredds/catalogs/ornldaac/ornldaac.html to browse the ORNL DAAC THREDDS data server and find data of your interest. In the following examples, it's assumed the data of interest is *2013 daily maximum temperature* in the "Daymet: Daily Surface Weather Data on a 1-km Grid for North America, Version 2" data set. Get its OPeNDAP data access URL (http://thredds.daac.ornl.gov/thredds/dodsC/ornldaac/1219/2013/tmax_2013.nc4) from the OPeNDAP Dataset Access Form.

Retrieve, process, and map data from ORNL DAAC THREDDS data server

1. Get metadata (e.g. spatial reference system) of the *2013 daily maximum temperature* data. http://thredds.daac.ornl.gov/thredds/catalog/ornldaac/1219/2013/catalog.html?dataset=1219/2013/tmax_2013.nc4 lists its metadata. We can find its spatial reference system definition (in proj4 format) is "+proj=lcc +lat_1=25 +lat_2=60 +lat_0=42.5 +lon_0=-100 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs".

2. Prepare a shapefile of conterminous U.S. (shown in Figure 1) and get its bounding box in Daymet data's spatial reference system.

   Bounding box is (west: -1949774, south: -1785120, east: 2426712, north: 946089)

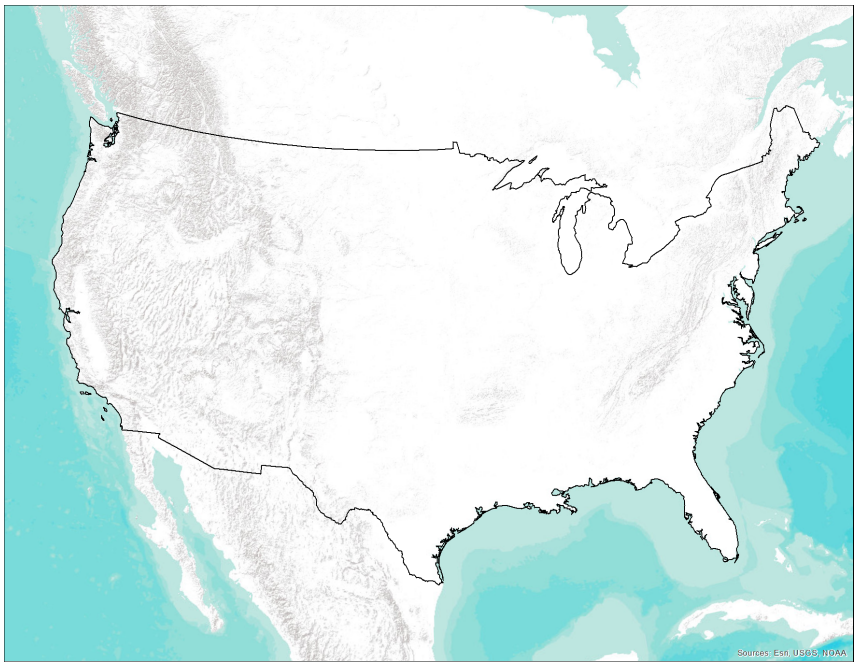


Figure 1. Boundary of conterminous U.S.

3. Subset and retrieve remote data from ORNL DAAC THREDDS data server
   The *2013 daily maximum temperature* data contains 365 days of 1-km data in North America. In this case, we are interested in maximum temperature on Jan. 1st, 2013 for conterminous U.S.

Using the "**OPeNDAP to NetCDF**" tool in the "**Multidimension Supplemental Tools**" toolbox, we can subset the *2013 daily maximum temperature* data and retrieve the subset from the remote ORNL DAAC THREDDS data server on the fly. Figure 2 shows the parameters used to invoke this tool.

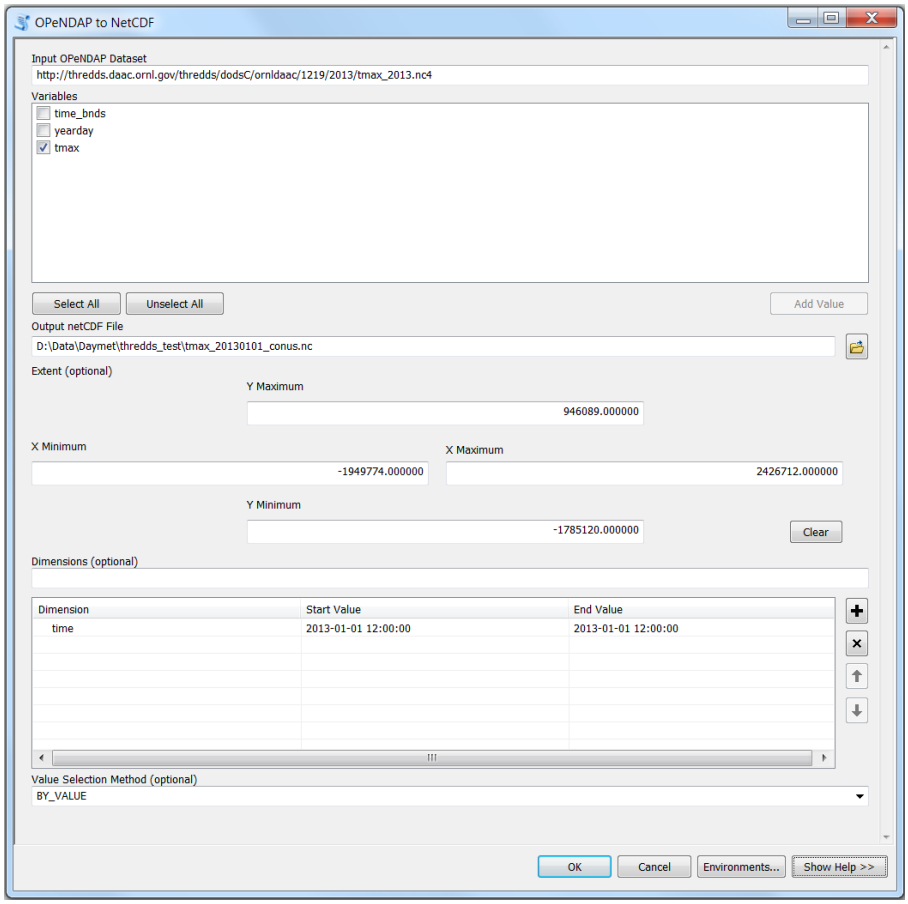


Figure 2. Invoking "OPeNDAP to NetCDF"

The "OPeNDAP to NetCDF" tool will save the subset maximum temperature data on Jan. 1st, 2013 for conterminous U.S. in a local NetCDF file: tmax_20130101_conus.nc.

4. Import the saved NetCDF file into ArcGIS as a raster layer
   Using the "**Make NetCDF Raster Layer**" tool in the "**Multidimension Tools** " toolbox, we can import the subset data into ArcGIS as a raster layer for further processings. Figure 3 shows the parameters used to invoke this tool. This tool will create a raster layer called "tmax_20130101_conus" (Figure 4).

5. Clip raster layer "tmax_20130101_conus" to remove grid cells outside of the conterminous U.S. boundary
   Since we only used a rectangular bounding box to subset the maximum temperature data, as shown in Figure 4, there are still pixels with valid data values outside of the conterminous U.S. boundary. We want to clip raster layer "tmax_20130101_conus" so that all grid cells outside of the conterminous U.S. will be removed (or filled with

missing value). The “Clip” tool in the “Coverage” toolbox is the traditional way to accomplish this, but it requires a stand-alone Arc/Info license. So in this example, we use a special way to achieve the same goal.

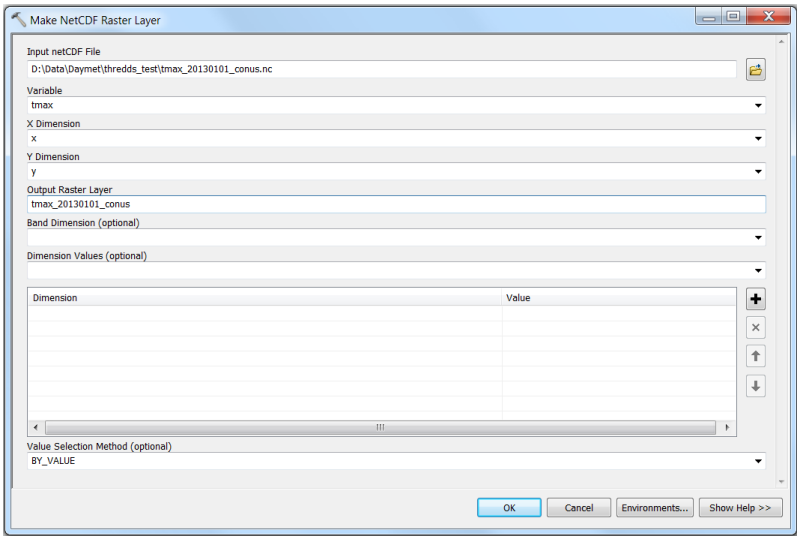


Figure 3. Invoking “Make NetCDF Raster Layer”

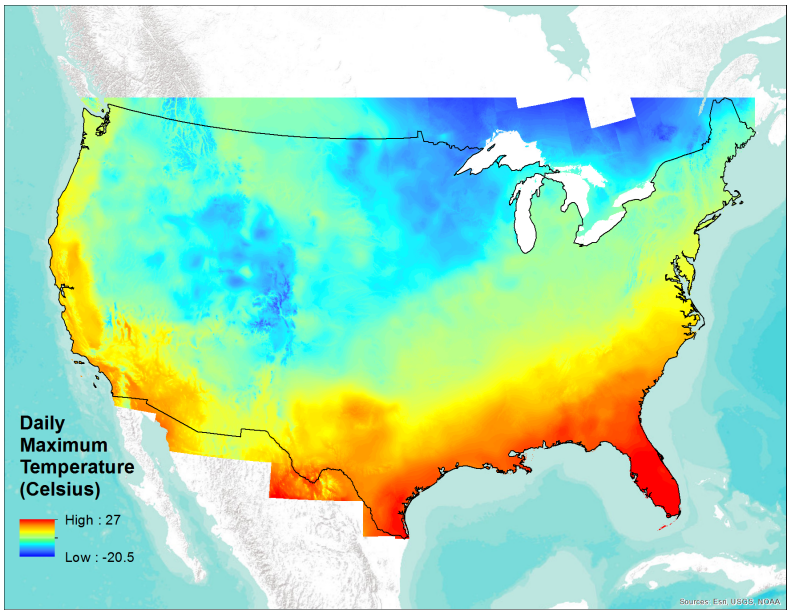


Figure 4. Raster layer “tmax_20130101_conus”

We use the “Times” tool in the “Spatial Analysis” toolbox and simply multiply raster layer “tmax_20130101_conus” with a constant value of 1.0. This processing will not change the values of raster layer “tmax_20130101_conus”. But by properly setting the “Mask” environment variable for this tool, grid cells outside of the conterminous U.S. boundary can be removed. Figure 5 and 6 shows the parameters used to invoke the “Times” tool and its runtime environment variables. As shown in Figure 6, the conterminous U.S. boundary shapefile is used as the “Mask” environment variable. The

output of the “Times” tool is a new raster layer “tmax_20130101_conus_clip”. As shown in Figure 7, the “clipped” layer perfectly fits the conterminous U.S. boundary.

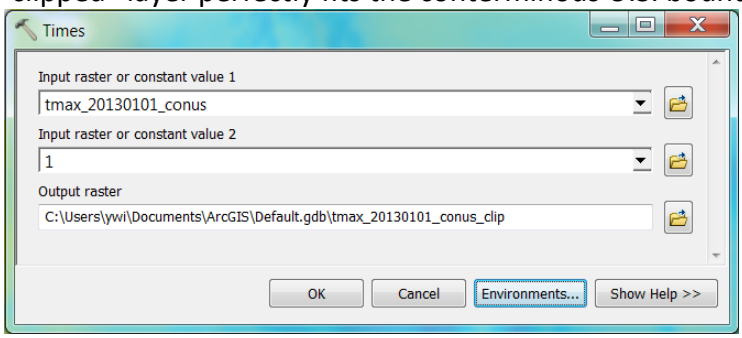


Figure 5. Invoking “Time”

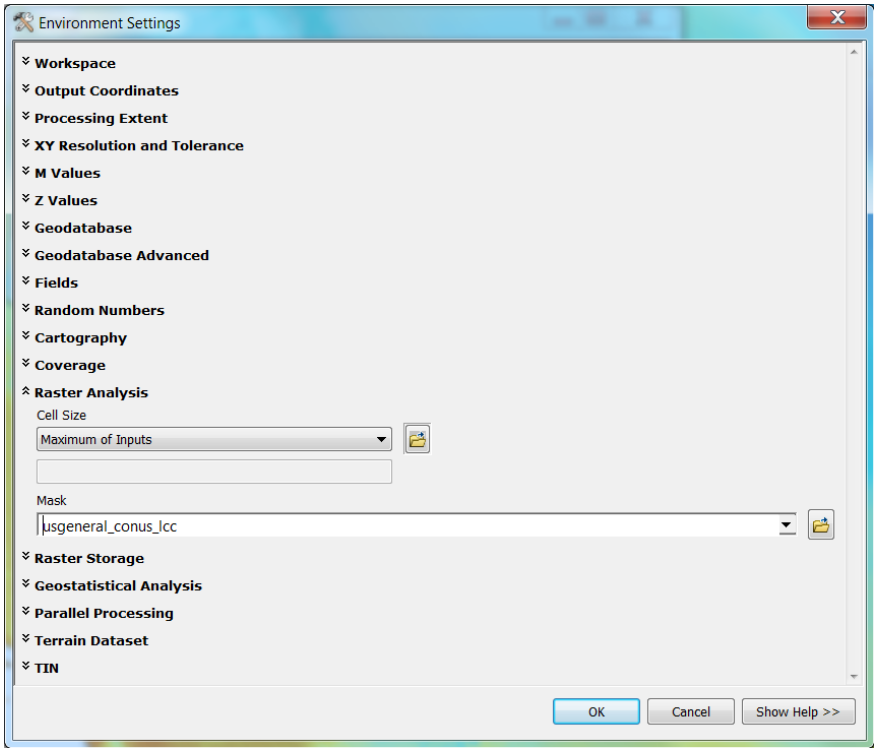


Figure 6. Environment Variables for invoking “Times”

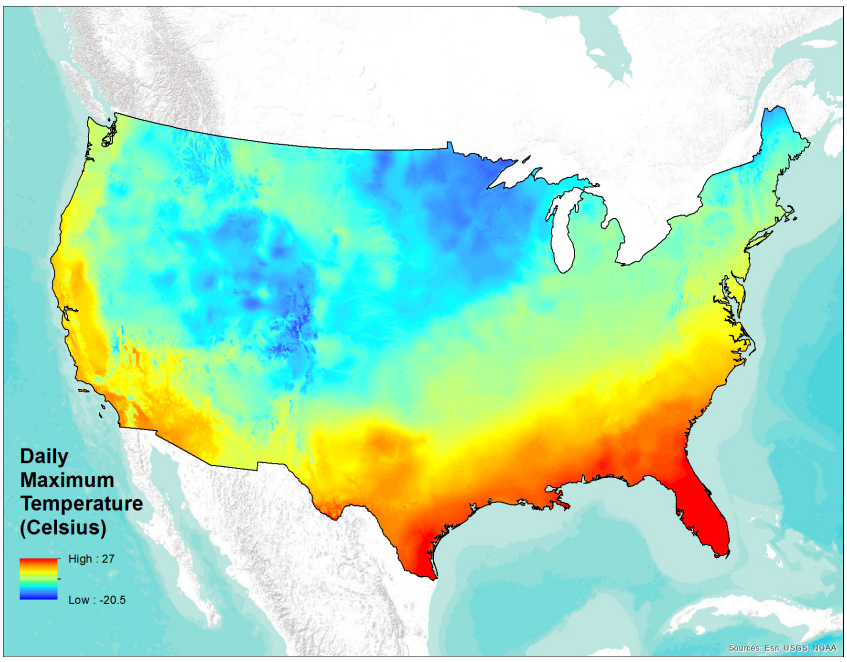


Figure 7. Raster layer “tmax_20130101_conus_clip”