Data Sources and Conversion of Elevation Data for AERMAP

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National elevation data that can be input to AERMAP, the terrain preprocessor for the dispersion model AERMOD, are created and maintained as part of the National Geospatial Program of the US Geological Survey (USGS) and are products of the 3D Elevation Program (3DEP). 3DEP data are analogous to what the AERMAP User's Guide refers to as the National Elevation Dataset (NED). AERMAP requires that the elevation data are stored as GeoTIFF files which are georeferenced files in the Tagged Image File Format (TIFF). AERMAP also requires that the data in the GeoTIFF files are **not compressed**, meaning they should **not** be generated using a lossless compression algorithm including LZW, PACKBITS, or DEFLATE which are allowed per the TIFF 6.0 specifications, but AERMAP is not able to interpret. Data in the GeoTIFF file must be stored **uncompressed** for AERMAP to extract the data from the file.

3DEP Data Sources

The remainder of this document discusses two sources of 3DEP data for use with AERMAP. The primary source for elevation data and information about the data is the USGS and USGS websites related to the National Geospatial Program and the 3DEP. The USGS will have the most up-to-date data and related documentation for the data that are available. The USGS provides multiple avenues for accessing and downloading 3DEP data and in various resolutions and formats, including GeoTIFF files via the The National Map (TNM) Download site at https://apps.nationalmap.gov/downloader/#/. Using the TNM, users can download the necessary tiles for a user-defined domain in GeoTIFF format in 1 arc-second and 1/3 arc-second resolution (and 2 arc-second for Alaska). However, the GeoTIFF files have utilized compression of the elevation data which AERMAP cannot interpret, and thus, require further conversion.

As a secondary source, the EPA has made available on a public facing EPA server, an archive of converted AERMAP-ready 1 arc-second and 2 arc-second elevation data in GeoTIFF format that AERMAP can process directly without further conversion. Users should note, while these archived data do not require further conversion for AERMAP, they may not include the most recent updates applied by the USGS who maintain the 3DEP products. Again, the USGS should be the primary source for elevation data for use with AERMAP.

Instructions on how to use the USGS TNM Download tool and how to convert the GeoTIFF files downloaded from the USGS National Map to AERMAP-ready GeoTIFF files are provided in the subsequent sections, followed by instructions for accessing the EPA's archived datasets.

Downloading 3DEP Data Using the USGS TNM Download Tool

Elevation data at resolutions of 1 arc-second and 1/3 arc-second can be downloaded for a user-defined domain for the conterminous US (CONUS), Hawaii, and Puerto Rico in GeoTIFF format using the TNM Download tool. Data for Alaska are available in a resolution of 2 arc-seconds. Coverage of a single data tile is 1x1 degree. Multiple files may be required depending on the size of the domain specified by the user. The TNM Download tool now provides multiple ways for specifying the area you want to download. The steps are outlined below to download 1, 1/3, or 2 arc-second data for a user-defined domain using the Polygon selection tool.

1. Access The National Map Download tool at https://apps.nationalmap.gov/downloader/#/.
2. In the left frame of the page that loads, check "Elevation Products (3DEP)" to expand the list of elevation products. *See Figure 1*
3. Under "Subcategories" select either "1 arc-second DEM" or "1/3 arc-second DEM" for the CONUS or "2 arc-second DEM" for Alaska. Select "Current" beneath the resolution you are downloading. *See Figure 1*
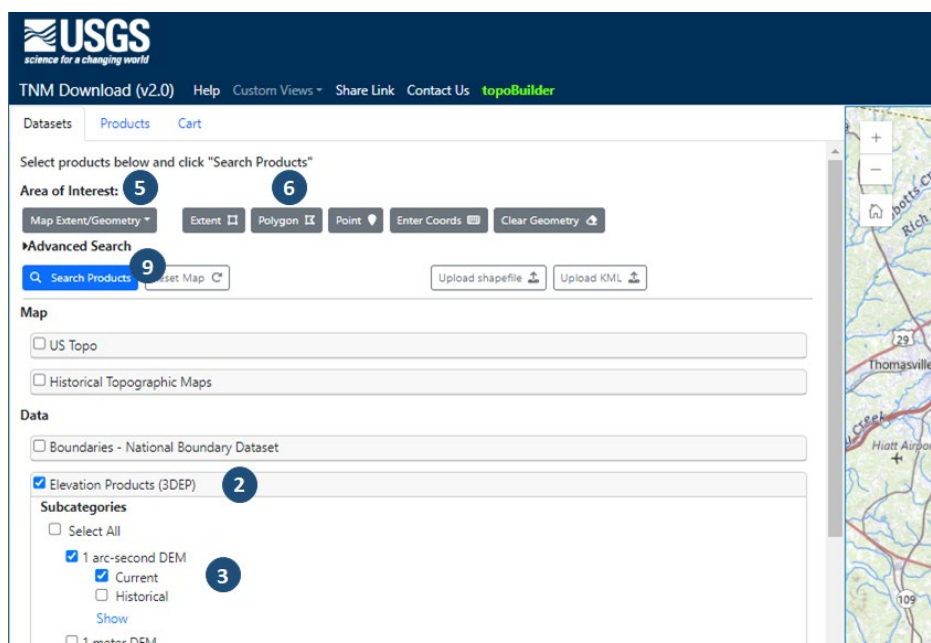

Figure 1. Top Left Frame of TNM Download Tool

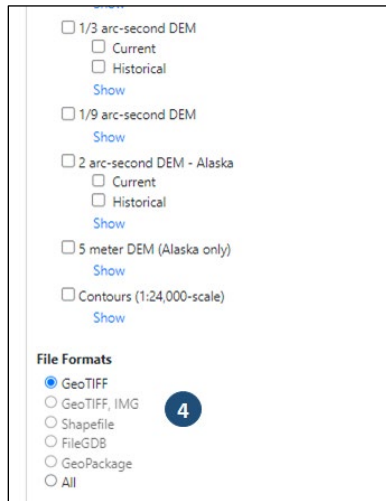4. Under "File Formats" ensure that "GeoTIFF" is selected. *See Figure 2*

Figure 2. Bottom Left Frame of TNM Download Tool

5. Under "Area of Interest" near the top of the left frame, select "Map Extent/Geometry." *See Figure 1*

6. Click on the "Polygon" option. *See Figure 1*

7. In the map frame on the right side of the page, zoom to the general area of interest.

8. Click on the map to define the vertices of the polygon for the area you want to download. Click the location of each vertex. Double-click to define the last vertex of the polygon. *See Figure 3*
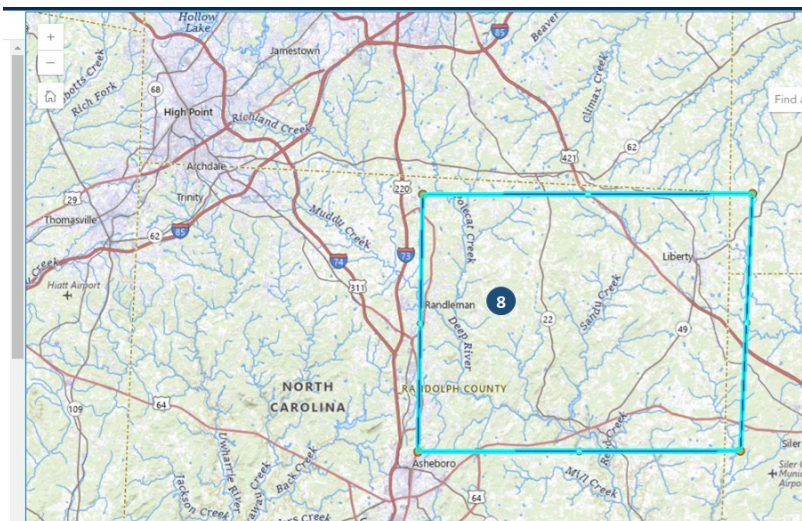

Figure 3. Map Frame of TNM Download Tool

9. In the left frame, click on "Search Products." *See Figure 1*
10. A list of files should display representing the tiles that cover the area of interest defined with the polygon tool. *See Figure 4*
11. For each file listed, click on the "Download Link (TIF)" link to download each file individually. *See Figure 4*
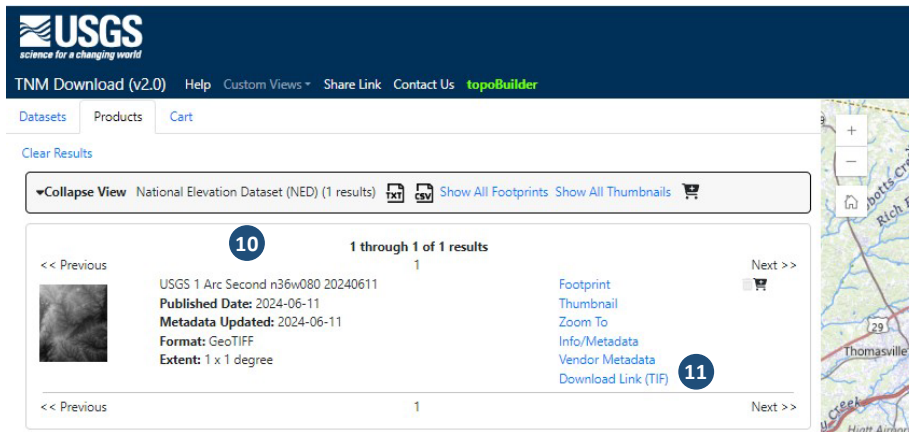

Figure 4. Elevation File List

Convert TNM GeoTIFF (with Compression) to GeoTIFF without Compression for AERMAP

The GeoTIFF file downloaded via the TNM in which data are compressed can be converted to a GeoTIFF without data compression using the using the Geospatial Data Abstraction Library (GDAL), specifically the translate program (gdal_translate.exe). Using the steps listed below, download and setup the x64 compiled GDAL binaries for Microsoft Windows at the following link: http://www.gisinternals.com/query.html?content=filelist&file=release-1900-x64-gdal-2-3-2-mapserver-7-2-1.zip. Updated versions of GDAL are available at the same site under the "Downloads" menu on the left sidebar, if preferred. The general instructions for using an updated version of GDAL should be the same or similar. There is also an archived copy of the zipped file linked above available on EPA's FTP server at:

https://gaftp.epa.gov/Air/aqmg/3dep/release-1900-x64-gdal-2-3-2-mapserver-7-2-1.zip.

The first set of instructions require the user to edit System Environment Variables on the computer where GDAL will be run. The advantage of this setup is that the GDAL executables can be called at a command prompt from within any directory as the working directory. Alternate instructions are also provided which enable the user to avoid editing System

Environment Variables but require the working directory at the command prompt to be set to the directory where the executable file and related supporting files are located.

1. Download GDAL as a compiled binary file in a single .zip package. (http://download.gisinternals.com/sdk/downloads/release-1900-x64-gdal-2-3-2-mapserver-7-2-1.zip)

2. Unzip the file in a folder (directory) of your choice. This will result in the creation of several subdirectories.

Setup with System Environment Variables

3. Locate gdal_translate.exe under bin\gdal\apps.

4. Add the absolute path of both the "bin" directory (where the ".dll" files are located) and the "apps" directory (where "gdal_translate.exe" is located) to your PATH Environment Variable.

5. Create a new environment variable named GDAL_DATA with a value set as the absolute path to the "gdal_data" directory which should be under the "bin" directory (e.g., bin\gdal-data).

6. Open a Windows command-prompt and set your working directory to the directory of your choice.

7. At the command-prompt call "gdal_translate.exe" with the following command-line arguments:

```
> gdal_translate  -of GTIFF  -co COMPRESS=NONE   path\filename-of-USGS-
geotiff-file   path\filename-of-converted-geotiff-file
```

Setup without System Environment Variables

3. Create a new local directory at a location and with a name of your choice. (e.g. "gdal")

4. Copy the GDAL program executable files (.exe) from bin\gdal\apps to your new directory.

5. Copy the .dll files from the bin\ directory to your new directory.

6. Copy the .csv files from the bin\gdal-data directory to your new directory. (When complete, your new directory created in #3 should contain copies of all of the GDAL .exe, .dll, and .csv files.)

7. Open a Windows command-prompt and set your working directory to the new directory that contains copies of the .exe, .dll, and .csv files.

8. At the command-prompt call "gdal_translate.exe" with the following command-line arguments:

```
> gdal_translate  -of GTIFF  -co COMPRESS=NONE   path\filename-of-USGS-
geotiff-file   path\filename-of-converted-geotiff-file
```

Downloading 3DEP Data in AERMAP-ready GeoTIFF Files from EPA

The EPA has converted and archived the 1-arc-second and 2 arc-second 3DEP data as a secondary source for obtaining 3DEP data that are AERMAP-ready GeoTIFF files and do not require further conversion. These files can be accessed with a web browser at https://gaftp.epa.gov/Air/aqmg/3dep/ or using FTP client software at ftp://newftp.epa.gov/Air/aqmg/3dep (username = anonymous) for bulk download. Files were converted using the GDAL Translate program and are named identically to the filenames used by the USGS TNM. Multiple full sets of files may be archived for historical purposes based on the *month-year* they were downloaded from USGS (e.g., 03-2020, 08-2024). The files are then subdivided by resolution (e.g., 1_arcsecond or 2_arcsecond). The filename identifies the latitude and longitude of the northwest most corner of the data file. Note: The USGS National Map should be the primary source for 3DEP data for use with AERMAP to ensure you are using the most up to date version of the data.

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