

## Data Sources and Conversion of Elevation Data for AERMAP

*Updated 4/7/2020*

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 tool at <https://viewer.nationalmap.gov/basic/>. 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 1 and 2 arc-second elevation data in GeoTIFF format that AERMAP can process directly without further conversion. User's 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 USGS TNM Download tool and how to convert the GeoTIFF with compression to GeoTIFF files with no compression 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 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. Follow the steps outlined below to download 1, 1/3, or 2 arc-second data for a user-defined domain.

1. Access The National Map Download tool at <https://viewer.nationalmap.gov/basic/>.
2. In the map frame on the right side of the page, zoom to the area of interest.
3. Click on the "Draw Rectangle" tool on the left side of the map (symbol is black square).
4. Click and drag to select the domain to be downloaded.
5. Under "Datasets" in the left panel of the page, check "Elevation Products (3DEP)" to expand the list of products.
6. Check "1 arc-second DEM" or "1/3 arc-second DEM" (or "2 arc-second DEM- Alaska") under "All Subcategories." (other products are not compatible with AERMAP.)
7. Confirm that the "Data Extent" displayed is 1 x 1 degree and the File Format is GeoTIFF. (These should be the defaults and cannot be changed.)
8. Click the "Find Products" button.
9. Click the "Download" link for each file to individually download each of the files listed. All files listed will be required to cover the domain specified. (Note: You can click the "Footprint" link to see an outline of the coverage for each file. Click the "Footprint" link again to turn off the coverage outline.)
10. Unzip to directory of choice.

### 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>. The first set of instructions require the user to edit system environment variables. 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 the first entry in the table. “Compiled binaries 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. (Your new directory created in #3 should not 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

A secondary source for obtaining 3DEP data that has been converted to AERMAP-ready GeoTIFF files that do not require further conversion is the EPA File Transfer Protocol (FTP) server at <ftp://newftp.epa.gov/Air/aqmg/3dep>. Files were converted using the GDAL Translate program to convert the 1x1 degree 1 arc-second and 2 arc-second GeoTIFF files (with compression) to GeoTIFF files (without compression) that can be processed directly with AERMAP without additional conversion or manipulation. The 1 arc-second and 2 arc-second files are segregated into different subdirectories, “1\_arcsecond” and “2\_arcsecond,” respectively, and can be accessed and downloaded directly via a web browser. Files are named identically to the filenames used by the USGS TNM in which the filename identifies the latitude and longitude of the northwest most corner of the data file. As stated previously, the USGS 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.

Please send questions to Clint Tillerson via email at [tillerson.clint@epa.gov](mailto:tillerson.clint@epa.gov).