Elevation Data Sources for TopoToImage 4.0

A comprehensive guide to finding and downloading Digital Elevation Model (DEM) data for use with TopoToImage 4.0.

Supported Formats

TopoToImage 4.0 supports these elevation data formats:

- BIL (.dem, .bil) - Band Interleaved by Line format

- GeoTIFF (.tif, .tiff) - Geographic Tagged Image File Format

Global Coverage Data Sources

1. GMTED2010 (Recommended for Global Coverage - Newer & Higher Resolution)

Best for: Modern global terrain visualization, continental mapping

- Source: [USGS Earth Explorer](https://earthexplorer.usgs.gov) / [GMTED2010 Homepage](https://www.usgs.gov/coastal-changes-and-impacts/gmted2010)

- Resolution: Multiple options:

- 7.5 arc-seconds (~250m) - 4x better than GTOPO30

- 15 arc-seconds (~500m) - 2x better than GTOPO30

• 30 arc-seconds (~1km) - Same as GTOPO30 but newer data

- Coverage: Global (84°N to 56°S latitude)

- Format: GeoTIFF (.tif), BIL (.bil)

- Data Quality: Significantly improved over GTOPO30 - newer sources, better void-filling

- Release: 2010 (vs GTOPO30's 1990s data)

Seven Statistical Products Available:

Each tile includes 6-7 different elevation products with specific use cases:

1. MEA (Mean) - `gmted_mea075.tif` ■ RECOMMENDED FOR TOPOTOIMAGE

• Average elevation within each grid cell
• Best overall terrain representation for general mapping
• Most commonly used for visualization applications

2. MED (Median) - `gmted_med075.tif`

• Middle value of elevation measurements

• Less affected by elevation outliers than mean

• Good for mixed terrain characteristics

3. MIN (Minimum) - `gmted_min075.tif`

• Lowest elevation value in each grid cell

• Useful for drainage analysis and valley identification

• Good for flood modeling applications

4. MAX (Maximum) - `gmted_max075.tif`

• Highest elevation value in each grid cell

• Excellent for identifying peaks and ridges

• Useful for watershed analysis and line-of-sight calculations

5. STD (Standard Deviation) - `gmted_std075.tif`

• Measures terrain roughness/elevation variation

• Higher values = more rugged terrain

• Lower values = flatter terrain

• Excellent for terrain complexity analysis

6. DSC (Systematic Subsample) - `gmted_dsc075.tif`

• Systematically selected elevation points

• Representative terrain sampling

• Good for general terrain modeling

7. Breakline Emphasis - Available for specialized terrain feature preservation

Download Instructions:

1. Visit [USGS Earth Explorer](https://earthexplorer.usgs.gov)

2. Register for free account

3. Search for "GMTED2010"

4. Choose resolution: 7.5", 15", or 30" arc-seconds

5. Select tiles for your area of interest

6. Download will include multiple .tif files - use MEA (mean) for TopoToImage

2. GTOPO30 (Legacy Global Coverage)

Best for: Historical compatibility, older workflow reproduction

- Source: [USGS Earth Explorer](https://earthexplorer.usgs.gov)

- Resolution: 30 arc-seconds (~1km at equator)

- Coverage: Complete global coverage

- Format: BIL (.dem files)

- File Size: ~12GB for complete global dataset

- Coordinate System: WGS84 Geographic (decimal degrees)

- Tile Structure: 50° × 40° tiles (e.g., gt30e020n40.dem)

- Note: Consider GMTED2010 instead - same resolution but newer, higher quality data

Download Instructions:

1. Visit [USGS Earth Explorer](https://earthexplorer.usgs.gov)

2. Register for free account

3. Search for "GTOPO30"

4. Select your area of interest or download full global dataset

5. Download includes: .dem (data), .hdr (header), .prj (projection), .stx (statistics)

3. SRTM (Shuttle Radar Topography Mission)

Best for: High-resolution regional mapping between 60°N-60°S

- Source: [NASA Earthdata](https://earthdata.nasa.gov)

- Resolution: 1 arc-second (~30m) or 3 arc-second (~90m)

- Coverage: 60°N to 60°S latitude (no polar regions)

- Format: GeoTIFF (.tif) or BIL (.bil)

- File Size: Varies by region (~25-50MB per 1° tile)

- Coordinate System: WGS84 Geographic

- Tile Structure: 1° × 1° tiles

Download Instructions:

1. Visit [NASA Earthdata](https://earthdata.nasa.gov)

2. Register for free NASA account

3. Browse to "SRTM Digital Elevation Data"

4. Choose SRTM 1-Arc Second or 3-Arc Second Global

5. Download individual tiles for your area of interest

4. ASTER GDEM (Advanced Spaceborne Thermal Emission)

Best for: Detailed regional studies, mountain areas

- Source: [NASA Earthdata](https://earthdata.nasa.gov) or [USGS Earth Explorer](https://earthexplorer.usgs.gov)

- Resolution: 1 arc-second (~30m)

- Coverage: 83°N to 83°S latitude

- Format: GeoTIFF (.tif)

- File Size: ~25MB per 1° tile

- Coordinate System: WGS84 Geographic

- Quality: Good detail, some artifacts in water areas

Regional High-Resolution Sources

5. USGS National Elevation Dataset (NED) - United States

Best for: Detailed US terrain mapping

- Source: [USGS National Map](https://apps.nationalmap.gov/downloader/)

- Resolution: 1/3 arc-second (~10m), 1 arc-second (~30m)

- Coverage: United States only

- Format: GeoTIFF (.tif)

- Coordinate System: NAD83 Geographic

- Quality: Highest quality for US areas

6. CDEM (Canadian Digital Elevation Model)

Best for: Canadian terrain mapping

- Source: [Natural Resources Canada](https://open.canada.ca/data/en/dataset/7f245e4d-76c2-4caa-951a-45d1d2051333)

- Resolution: Various (0.75 arc-second to 3 arc-second)

- Coverage: Canada only

- Format: GeoTIFF (.tif)

- Quality: High quality, regularly updated

7. EU-DEM (European Digital Elevation Model)

Best for: European terrain mapping

- Source: [Copernicus Land Monitoring Service](https://land.copernicus.eu/imagery-in-situ/eu-dem)

- Resolution: 1 arc-second (~25m)

- Coverage: European Union + surrounding areas

- Format: GeoTIFF (.tif)

- Quality: Very high quality, seamless coverage

8. ODP1 (Open Data Portal - European Data)

Best for: High-resolution Western European terrain

- Source: sonny.4lima.de (Compiled European elevation data)

- Resolution: 1 arc-second (~30m)

- Coverage: Western Europe and Iceland

- Format: Various (processed data)

- Quality: Compiled from various European sources

- Note: Part of GPS Visualizer's elevation services

Specialized and Commercial Sources

9. OpenTopography

Best for: Research-grade, high-resolution lidar data

- Source: [OpenTopography.org](https://opentopography.org)

- Resolution: Sub-meter to 30m depending on dataset

- Coverage: Selected areas worldwide

- Format: Various including GeoTIFF

- Cost: Free for research/education, registration required

10. GEBCO (General Bathymetric Chart of the Oceans)

Best for: Ocean depth data, underwater terrain

- Source: [GEBCO.net](https://www.gebco.net)

- Resolution: 15 arc-second (~450m)

- Coverage: Global ocean floor + land elevation

- Format: GeoTIFF (.tif)

- Specialty: Combines bathymetry with terrestrial elevation

11. SRTM30+ (Global 1km DEM with Bathymetry)

Best for: Global mapping equivalent to GTOPO30 but with ocean floor data

- Source: [NOAA Data Catalog](https://catalog.data.gov/dataset/srtm30-global-1-km-digital-elevation-model-dem-version-11-land-surface) / [PacIOOS](https://www.pacioos.hawaii.edu/metadata/srtm30plus_v11_land.html)

- Resolution: 30 arc-seconds (~1km) - same as GTOPO30

- Coverage: Complete global coverage (land + ocean floor)

- Format: NetCDF, GeoTIFF available through ERDDAP servers

- Data Components:

• Land: SRTM-derived elevation data (GTOPO30 for polar regions)
• Ocean: Smith & Sandwell bathymetry with high-resolution additions
- Versions: Version 11 (current), Version 6.0 (older)

- Specialty: Combines SRTM/GTOPO30 land data with comprehensive ocean bathymetry

12. ETOPO (Earth Topography and Ocean Bathymetry)

Best for: High-resolution ocean floor mapping, global relief

- Source: [NOAA National Centers for Environmental Information](https://www.ncei.noaa.gov/products/etopo-global-relief-model)

- Resolution: Multiple options - ETOPO 2022 (15 arc-second), ETOPO1 (1 arc-minute)

- Coverage: Global land and ocean floor elevation

- Format: GeoTIFF (.tif), NetCDF

- Data Range: ~-11,000m (ocean trenches) to +8,850m (Mount Everest)

- Specialty: NOAA's premier global relief dataset, combines land topography with ocean bathymetry

- Quality: High-quality bathymetry data, regularly updated with latest surveys

Quick Start Recommendations

For Beginners

1. Start with sample data (included with TopoToImage)

• Location: `assets/sample_data/`
• Perfect for learning the software

For Regional Work

1. SRTM data from NASA Earthdata

• High resolution (30m)
• Easy to download
• Good quality

For Global Projects

1. GMTED2010 from USGS Earth Explorer ■ RECOMMENDED

- Best modern global dataset

• Multiple resolutions (250m, 500m, 1km)

• 2010 data quality vs 1990s GTOPO30

• Available in GeoTIFF format

2. SRTM30+ from NOAA (if you want ocean floor data)

• Same resolution as GTOPO30 (~1km)

• Includes ocean bathymetry

• Global land + sea floor coverage

3. GTOPO30 from USGS Earth Explorer (legacy option)

• Complete world coverage including full polar regions

• Consider GMTED2010 instead for most applications

For Professional/Research Use

1. National datasets (NED, CDEM, EU-DEM)

• Highest available resolution for specific countries

• Best accuracy and quality

• Regular updates

File Organization Tips

Recommended Directory Structure

```
~/elevation_data/
■■■ GTOPO30/
■ ■■■ gt30w180n90.dem
■ ■■■ gt30w180n90.hdr
■ ■■■ ...
■■■ SRTM/
■ ■■■ n40_w075_1arc_v3.tif
■ ■■■ ...
■■■ regional/
■ ■■■ US_NED/
■ ■■■ Canada_CDEM/
■ ■■■ ...
■■■ sample_data/
■■■ test_dem.tif
```

Loading in TopoToImage 4.0

1. File → Open Database - Load single-file or multi-file databases

2. File → Create Multi-File Database - Create metadata for folder of elevation tiles

3. File → Recent Databases - Quick access to previously used datasets

Data Quality Considerations

GMTED2010

- ■ Best overall global dataset - newer, higher quality than GTOPO30

- ■ Multiple resolution options (250m, 500m, 1km)
- ■ Modern data sources (2010 vs 1990s)
- ■ Superior void-filling and processing techniques
- ■ Available in both GeoTIFF and BIL formats
- ■■ Slightly smaller coverage area than GTOPO30 (84°N to 56°S vs full polar)

GTOPO30 (Legacy)

- ■ Global coverage including full polar regions
- ■ Consistent quality, time-tested
- ■■ Outdated - replaced by GMTED2010 for most applications

- ■■ Lower resolution (1km only)
- ■■ Based on 1990s data

SRTM

- ■ High resolution (30m)
- ■ Good accuracy
- ■■ No coverage above 60°N/below 60°S
- ■■ Some gaps in original data

ASTER GDEM

- ■ High resolution (30m)
- ■ Near-global coverage
- ■■ Some artifacts over water
- ■■ Cloud contamination possible

National Datasets

- ■ Highest quality and resolution
- ■ Regular updates
- ■■ Limited to specific countries
- ■■ Varying coordinate systems

SRTM30+, GEBCO & ETOPO (Ocean Floor Data)

- ■ Unique ocean floor visualization capability
- ■ Seamless land-to-ocean transitions
- ■ Global coverage including polar regions
- ■ Dramatic depth visualization (trenches, ridges, continental shelves)
- ■ SRTM30+: Uses familiar GTOPO30/SRTM land data with bathymetry

- ■■ Lower resolution than land-only datasets
- ■■ Large elevation range requires careful gradient design
- ■■ SRTM30+: Primarily available in NetCDF format (may require conversion)

Coordinate System Requirements

■ Supported by TopoToImage 4.0:

- WGS84 Geographic (decimal degrees)
- NAD83 Geographic (decimal degrees)
- NAD27 Geographic (decimal degrees)

■ Not Supported:

- UTM (Universal Transverse Mercator)
- State Plane coordinates
- Web Mercator
- Any projected coordinate system using linear units

Note: If your data is in a projected coordinate system, you'll need to reproject it to geographic coordinates using GIS software like QGIS (free) before using it with TopoToImage.

Legal and Usage Considerations

Public Domain Data

- GTOPO30, SRTM, ASTER GDEM: Free for any use
- US NED: Public domain within US
- Most government datasets: Free for public use

Attribution Requirements

• NASA/USGS datasets: Attribution appreciated but not required

• ASTER GDEM: Credit to NASA/METI required

• OpenTopography: Check individual dataset requirements

Commercial Use

• Most sources listed here are free for commercial use

• Check specific dataset licenses for commercial applications

• Consider professional data sources for critical applications

Getting Help

Data Download Issues

• Most sites require free registration

• Large downloads may need download managers

• Contact data providers' support for access issues

Format Compatibility

• Ensure data is in geographic coordinates (lat/lon)

• Verify file extensions (.dem, .bil, .tif, .tiff)

• Check that header files (.hdr) exist for BIL format data

TopoToImage 4.0 Support

• Check SUPPORTED_FORMATS.md for technical details

• Test with sample data first

• Use File → Open DEM File to verify compatibility

This guide covers the most commonly used and freely available elevation data sources. For specialized applications or regions, additional sources may be available through national mapping agencies or commercial providers.