Digital Elevation Model (DEM) of Minnesota: statewide, 1:24,000, Level 2, raster

This page last updated: 06/29/2012
Metadata created using Minnesota Geographic Metadata Guidelines

---

Go to Section:

Section 1 Overview

Originator	Minnesota Geospatial Information Office (MnGeo)
Title	Digital Elevation Model (DEM) of Minnesota: statewide, 1:24,000, Level 2, raster
Abstract	This data set was created from U.S. Geological Survey (USGS) digital elevation models (DEMs). The DEMs were standardized to 30 meter grid cells, UTM Zone 15, NAD83, vertical units in feet and were joined into one statewide file (also available as county files). All the DEMs are Level 2 quality except Town Line Lake, Grand Portage and Grand Portage OE N which likely are still Level 1. The Minnesota Department of Natural Resources created the Level 2 DEMs for 88 quads in the Twin Cities metropolitan area.
Purpose	DEMs can be used as layers in geographic information systems for a number of purposes including landscape analysis, hillshade generation for cartographic products, slope determination, volumetric analysis, site location of towers, or for drainage basin delineation.
Time Period of Content Date	
Currentness Reference	The dates of source materials have not been researched at this time.
Progress	Complete
Maintenance and	None Planned

Update Frequency	
Spatial Extent of Data	Minnesota
Bounding Coordinates	-97.25 -89.5 49.4 43.5
Place Keywords	Minnesota
Theme Keywords	elevation, Digital Elevation Model, DEM, Digital Terrain Model, DTM, topography, hypsography, altitude, height
Theme Keyword Thesaurus	ISO 19115 Topic Category
Access Constraints	None
Use Constraints	See Disclaimer field for complete use conditions.
Contact Person Information	Pete Olson, Systems Administrator Minnesota Geospatial Information Office 658 Cedar Street St. Paul, MN 55155 Phone: 651-201-2467 Fax: 651-296-3698 Email: gisinfo.mngeo@state.mn.us
Browse Graphic	None available.
Associated Data Sets	For more information about elevation data for Minnesota, see: www.mngeo.state.mn.us/chouse/elevation/index.html

Section 2 Data Quality

Attribute Accuracy	The accuracy of the original USGS DEM is dependent upon the level of detail of the source and the grid spacing used to sample that source. The primary limiting factor for the level of detail of the source is the scale of the source materials. The proper selection of grid spacing determines the level of content that may be extracted from a given source during digitization.
Logical Consistency	There are no known problems with the files.
Completeness	The original USGS DEM is visually inspected by USGS for completeness on a DEM view and edit system for the purpose of performing a final quality control and if necessary edit of the DEM.

Horizontal Positional Accuracy

Unknown

Vertical Positional Accuracy

Note: All the DEMs used to create this file are Level 2, except that Town Line Lake, Grand Portage and Grand Portage OE N are likely still Level 1. For an explanation of the Levels, see: www.lmic.state.mn.us/bmap90/dem/demprob.htm

The vertical RMSE statistic is used to describe the vertical accuracy of the original USGS DEM, encompassing both random and systematic errors introduced during production of the data. Accuracy is computed by a comparison of linear interpolated elevations in the DEM with corresponding known elevations. Test points are well distributed, representative of the terrain, and have true elevations with accuracies well within the DEM accuracy criteria. Acceptable test points include, in order of preference: field control, aerotriangulated test points, spot elevations, or points on contours from existing source maps with appropriate contour interval. A minimum of 28 test points per DEM is required to compute the RMSE, which is composed of a single test using 20 interior points and 8 edge points. Edge points are those which are located along, at, or near the quadrangle neatlines and are deemed by the editor to be useful to evaluating the accuracy of the edge of the DEM. Collection of test point data and comparison of the DEM with the quadrangle hypsography are conducted by the quality control units within the USGS.

There are three types of DEM vertical errors: blunder, systematic, and random. These errors are reduced in magnitude by editing but cannot be completely eliminated. Blunder errors are those errors of major proportions and are easily identified and removed during interactive editing. Systematic errors are those errors that follow some fixed pattern and are introduced by data collection procedures and systems. These error artifacts include: vertical elevation shifts, misinterpretation of terrain surface due to trees, buildings and shadows, and fictitious ridges, tops, benches or striations. Random errors result from unknown or accidental causes.

DEMs are edited to correctly depict elevation surfaces that correspond to water bodies of specified size.

Level 1 DEM: A RMSE of 7 meters or less is the desired accuracy standard. A RMSE of 15 meters is the maximum permitted. A 7.5-minute DEM at this level has an absolute elevation error tolerance of 50 meters (approximately three times the 15-meter RMSE) for blunder errors for any grid node when compared to the true elevation. Any array of points in the DEM can not encompass more than 49 contiguous elevations in error by more than 21 meters (three times the 7-meter RMSE). Systematic errors that are within stated accuracy standards are tolerated.

Distinct north-south tonal banding may be visible in Level 1 quads with larger RMSE's. This data noise becomes especially prevalent in derived products, such as hillshades, aspect, and slope layers.

Level 2 DEM: A vertical RMSE of one-half of the contour interval, determined by the source map, is the maximum permitted. Systematic errors may not exceed one contour interval, determined by the source map, is the maximum permitted. Systematic errors may not exceed one contour interval specified by the source graphic. Level 2 DEMs have been processed or smoothed for consistency and edited to remove identifiable systematic errors.

Lineage

Original USGS DEM Processing Steps

The production procedures, instrumentation, hardware and software used in the collection of standard U. S. Geological Survey (USGS) Digital Elevation Models (DEMs) vary depending on systems used at the contractor, cooperator or National Mapping Division (NMD) production sites. The following steps describe, in general, the process used in the production of standard USGS DEM datasets.

Level 1 DEM: Level 1 DEMs are acquired photogrammetrically by manual profiling or image correlation techniques from National Aerial Photography Program (NAPP) or equivalent source photographs. Level 1 30-minute DEMs may be derived or resampled from level 1 7.5-minute DEMs.

Level 2 DEM: Level 2 DEMs are produced by converting 1:24,000-scale and 1:100,000-scale hypsography digital line graph (DLG) data to DEM format or the DEMs are generated from vector data derived from scanned raster files of USGS 1:24,000-scale or 1:100,000-scale map series contour separates.

Water body editing: DEM surface areas corresponding to water bodies are flattened and assigned map specified or estimated surface elevations. Water body areas are defined as ponds, lakes, and reservoirs that exceed 0.5 inches at map scale and double line drainage that exceeds 0.25 inches at map scale. Water body shorelines are derived either from a hypsographic DLG or by interactive delineation from 1:24,000-scale or 1:100,000-scale USGS map series.

Edge matching: DEM datasets within a project area (consisting of a number of adjacent files) are edge matched to assure terrain surface continuity between files. Edge matching is the process of correcting adjacent elevation values along common edges. The objective of edge matching is to create more accurate terrain representations by correcting the alignment of ridges and drains, and overall topographic shaping within an approximately 25-30 row or column grid post zone on both edges.

Quality control: DEMs are viewed on interactive editing systems to identify and correct blunder and systematic errors. DEMs are verified for physical format and logical consistency at the production centers and before archiving in the National Digital Cartographic Data Base (NDCDB) utilizing the Digital Elevation Model Verification System (DVS) software.

LMIC's (now MnGeo's) Processing Steps

All processing was done using EPPL7 software.

1. DEMs that were in UTM Zone 14 or 16 were converted to Zone 15 using the PROJECT command.

2. DEMs that were in NAD27 were adjusted to NAD83 by shifting by the difference between NAD83 and NAD27, rounded to the 30 meter cell size. Generally this was a northward shift of 7 cells with no east/west shift.

3. DEMs with vertical units in meters were converted to feet by multiplying by 3.28 and rounding to the nearest foot.

4. All files were joined together into one statewide file by using ALIGN and MOSAIC commands. Sliver areas (usually created between DEMs that had been shifted to NAD83 and those that were originally NAD83) were filled by averaging adjacent cells.

5. The EPPL7 format file was exported to ERDAS format.

6. In early 2001, LMIC recreated the statewide file in order to incorporate new Level 2 files from USGS and MnDNR (83 quads from USGS; 88 quads from DNR). A few scattered cells with values that were less than 600 feet (the level of Lake Superior in the file) were set to the values of the surrounding cells. The EPPL file was exported to ARC GRID and ERDAS formats.

DNR's processing steps:

DNR created the Level 2 files from 1:24,000-scale USGS DLG Hypsography files. These files were converted to Arc/INFO coverage format and then converted to a 30 meter DEM using a surface modelling program called ANUDEM, developed by the Australian National University. For more information on ANUDEM, see: fennerschool.anu.edu.au/research/publications/software-datasets/anudem The DEM was provided to LMIC in ARC GRID format.

Section 3 Spatial Data Organization (not used in this metadata)

Section 4 Coordinate System

Horizontal Universal Transverse Mercator

Coordinate Scheme	
UTM Zone Number	15E
Horizontal Datum	NAD83
Horizontal Units	meters
Cell Width	30
Cell Height	30

Section 5 Attributes

Overview	Elevation values are integer raster values in a 30 meter sampling grid.
Detailed Citation	U.S. Department of the Interior, U.S. Geological Survey, 'Digital Elevation Models -- Data Users Guide', Reston, VA, eros.usgs.gov/#/Guides/dem U.S. Department of the Interior, U.S. Geological Survey, Standards for Digital Elevation Models: Reston, VA, nationalmap.gov/standards/demstds.html
Table Detail:	

Section 6 Distribution

Publisher	Minnesota Geospatial Information Office (MnGeo)
Publication Date	04/2001
Contact Person Information	Nancy Rader, GIS Data Coordinator Minnesota Geospatial Information Office 658 Cedar Street St. Paul, MN 55155 Phone: 651-201-2489 Fax: 651-296-3698 Email: gisinfo.mngeo@state.mn.us
Distributor's Data Set Identifier	30 meter DEM, statewide file
Distribution Liability	DISTRIBUTION LIABILITY STATEMENT For data or maps delivered online or by physical media by the Minnesota Geospatial Information Office (MnGeo), formerly the Land Management Information Center (LMIC)

Limitations: Although extensive effort has been made to produce error-free and complete data, all geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials. Users should consult available data documentation (metadata) for this particular data to determine limitations and the precision to which the data depict distance, direction, location or other geographic characteristics. Data may be subject to change without prior notification.

No warranty: Data is provided "as is," without any warranty whatsoever, including but not limited to any warranty as to performance, merchantability or fitness for any particular purpose.

Liability: The entire risk as to the results of the use of this data is assumed by the user. MnGeo is not responsible for any interpretation or conclusions made by those who acquire or use it. MnGeo shall not be liable for any direct, indirect, special, incidental, compensatory or consequential damages or third-party claims resulting from the use of this data, even if MnGeo has been advised of the possibility of such potential loss or damage. In states that do not allow the exclusion or limitation of incidental or consequential damages, this data may not be used.

Redistribution conditions: In obtaining this data from MnGeo, it is understood that you and/or your organization have the right to use it for any purpose. If you modify it, you are encouraged to apply responsible best practices by documenting those changes in a metadata record. If you transmit or provide the data to another user, it is your responsibility to provide appropriate content, limitation, warranty and liability information as you see fit.

Data delivered on electronic media: If data has been requested from MnGeo on magnetic media, CD or any other physical media, MnGeo will deliver it in the computer-readable format agreed upon with the requestor. MnGeo will reissue data if it is unreadable by correctly adjusted computer input devices or when the media is delivered in a damaged condition. Requests for reissue of this digital data product must be made within 30 days of the date shipped from MnGeo.

Ordering Instructions

NOTE: The statewide files are very large. To minimize downloading time, only one format (ARC GRID) is delivered when you choose 'I AGREE' in the Online Linkage field. Instructions for getting each of the three formats are provided below. If you only need part of the state, the ARC GRID county files from DNR may be the best option.

1a. ARC GRID format (statewide file): This data set is distributed on the internet by clicking below after Online Linkage. Doing so will tell your browser to start downloading the DEMARC.ZIP file which will contain the following:

- The statewide elevation file in ARC GRID format
- Metadata (.html) file for the dataset
- NOTICE.TXT: disclaimer

After downloading the DEMARC.ZIP file, unzip it using unzipping software such as PKUNZIP or WinZip.
NOTE: In order to restore the subdirectories (the DEMARC and INFO directories):
- PKUNZIP: Use the '-d' option (pkunzip -d demarc.zip)
- WinZip: Make sure that the 'Use Folder Names' box is checked when you extract the files.

For links to websites for obtaining unzipping software, see:
www.gda.state.mn.us/resource.html?Id=16253#compress

1b. ARC GRID format (county files): Available from the MN Dept. of Natural Resources at:
deli.dnr.state.mn.us/metadata/elev_dem30rt3.html

2. ERDAS format: Go to MnGeo's FTP site: ftp.lmic.state.mn.us/pub/data/elevation and download the DEMERD.ZIP file.

3. EPPL7 format: Go to MnGeo's FTP site: ftp.lmic.state.mn.us/pub/data/elevation and download the DEMEPP.ZIP file.

Online Linkage

I AGREE to the notice in "Distribution Liability" above. Clicking to agree will either begin the download process or link to download information. See "Ordering Instructions" above for details.

Section 7 Metadata Reference

Metadata Date

06/29/2012

Contact Person Information

Nancy Rader, GIS Data Coordinator
Minnesota Geospatial Information Office
658 Cedar Street
St. Paul, MN 55155
Phone: 651-201-2489
Fax: 651-296-3698
Email: gisinfo.mngeo@state.mn.us

Metadata Standard Name

Minnesota Geographic Metadata Guidelines

Metadata Standard Version

1.2

Metadata Standard Online Linkage

http://www.mngeo.state.mn.us/committee/standards/mgmg/metadata.htm

This page last updated: 06/29/2012

Go back to top