OREGON STATE SERVICE CENTER FOR GIS (SSCGIS)

Metadata for 7.5-minute Digital Elevation Data
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These metadata describe the 7.5-minute DEM and lattice holdings of the SSCGIS for the state of Oregon. File-specific information for the individual quads is available as a separate comma-delimited file (QUADMETA.TXT) or DBASE file (QUADMETA.DBF).

Table of Contents

Identification_Information:

Citation:
Citation_Information
Originator: SSCGIS
Publication_Date: 199704
Title: 7.5 minute Digital Elevation Data
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Salem, OR
Publisher: SSCGIS
Description:
Abstract:
Two file formats are available on separate CDs; raw DEM and ARC/INFO lattice. Both provide coverage in 7.5- by 7.5-minute (30- by 30-m data spacing) block tiles across the state of Oregon . Each quad product provides the same coverage as a standard USGS 7.5-minute quadrangle and is not edgematch guarenteed, though some edgematching was already available by the data source contributors.

Raw DEMs

The raw DEM file is a series of elevations ordered from south to north with the order of the columns from west to east. The DEM is formatted as one ASCII header record (A- record), followed by a series of profile records (B- records) each of which include a short B-record header followed by a series of ASCII integer elevations per each profile. The last physical record of the DEM is an accuracy record (C-record).

Projection for the raw DEM source files is the Universal Transverse Mercator (UTM) projection. Refer to the SPATIAL_REFERENCE_INFORMATION section.

ARC/INFO lattice

The lattice or grid file is an ARC/INFO rasterized format of the DEM source file. It is a surface interpretation of a grid, represented by equally spaced sample points referenced to a common origin and a constant sampling distance in the x and y direction. Each mesh point contains the z value of that location, and is referenced to a common base z value, such as sea level.

Projection for the lattice files is in the Oregon Lambert standard projection. Refer to the SPATIAL_REFERENCE_INFORMATION section. Refer to www.sscgis.state.or.us for information about this state standard projection for public geospatial data exchange in Oregon.

Please refer to the comma-delimited text (QUADMETA.TXT) or DBASE file (QUADMETA.DBF) for metadata specific to each quad.

Purpose:

The digital elevation data can be used as source data for digital orthophotos, and, as layers in geographic information systems, for earth science analysis. DEM's can also serve as tools for volumetric analysis, for site location of towers, or for drainage basin delineation. These data were collected as part of the National Mapping Program.

Supplemental_Information:

7.5-minute DEMs have rows and columns which vary in length and are staggered. The projection bounding coordinates form a quadrilateral (no two sides are parallel to each other) rather than a rectangle. The user will need to PAD out the uneven rows and columns with blanks or flagged data values, if a rectangle is required for the user's application. Some software vendors have incorporated this function into their software for input of standard formatted USGS DEMs.

Time_Period_of_Content:
  Time_Period_Information:
    Range_of_Dates/Times:
      Beginning_Date: 197907
      Ending_Date: present
  Currentness_Reference: ground condition
Status
  Progress: In work
  Maintenance_and_Update_Frequency: Irregular
Spatial_Domain
  Bounding_Coordinates:
    West_Bounding_Coordinate: -124 37 30
    East_Bounding_Coordinate: -116 22 30
    North_Bounding_Coordinate: 46 22 30
    South_Bounding_Coordinate: 41 52 30
Keywords:
  Theme:

Theme_Keyword_Thesaurus: none
Theme_Keyword: DEM
Theme_Keyword: digital elevation model
Theme_Keyword: digital terrain model
Theme_Keyword: hypsography
Theme_Keyword: altitude
Theme_Keyword: height
Theme_Keyword: contour line
Theme_Keyword: digital contours
Place:
Place_Keyword_Thesaurus:
U.S. Department of Commerce, 1987, Codes for the identification of the States, the District of Columbia and the outlying areas of The United States, and associated areas (Federal Information Processing Standard 5-2): Washington, D. C., National Institute of Standards and Technology.
Place_Keyword: OR
Place_Keyword_Thesaurus:
U.S. Department of Commerce,1990, Counties and equivalent entities of The United States, its possessions, and associated areas (Federal Information Processing Standard 6-4): Washington, D.C. National Institute of Standards and Technology.
Place_Keyword: FIPS code for county or counties.
Access_Constraints: None
Use_Constraints:
None. The SSCGIS would like to acknowledgement that the data sources for the digital elevation data are the U.S. Geological Survey, the Bureau of Land Management, and the U.S. Forest Service.

Data_Quality_Information

Attribute_Accuracy:
Attribute_Accuracy_Report:
The accuracy of a 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_Report:
For USGS source data, the fidelity of the relationships encoded in the data structure of the DEM are automatically verified using a USGS software program upon completion of the data production cycle. The test verifies full compliance to the DEM specification.
Completeness_Report:
The DEM is visually inspected 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. The physical format of each digital elevation model is validated for content completeness and logical consistency during production quality control and prior to archiving in the National Digital Cartographic Data Base.

Due to the variable orientation of the quadrilateral in relation to the projection grid, profiles that pass within the bounds of

the DEM quadrilateral, may be void of elevation grid points, and are not represented in the DEM. This condition occurs infrequently and is always the first or last profile of the dataset.

Level 2 DEM: Level 2 DEM's may contain void areas due to interruptions to contours in the source graphic or DLG. Void area elevation grid posts are assigned the value of -32,767. In addition, suspect elevation areas may exist in the DEM but are not specifically identified. Suspect areas can be located on the source graphic as a "disturbed surface, " symbolized by contours overprinted with photorevised or other surface patterns.

Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:
The horizontal accuracy of the DEM is expressed as an estimated root mean square error (RMSE). The estimate of the RMSE is based upon horizontal accuracy tests of the DEM source materials which are selected as equal to or less than intended horizontal RMSE error of the DEM. The testing of horizontal accuracy of the source materials isaccomplished by comparing the planimetric (X and Y) coordinates of well-defined ground points with the coordinates of the same points as determined from a source of higher accuracy.
Quantitative_Horizontal_Positional_Accuracy_Assessment:
Horizontal_Positional_Accuracy_Value: RMSE of the DEM.
Horizontal_Positional_Accuracy_Explanation:
Digital elevation models meet horizontal National Map Accuracy Standards (NMAS) accuracy requirements.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
The vertical RMSE statistic is used to describe the vertical accuracy of a DEM, encompassing both random and systematic errors introduced during production of the data. The RMSE is encoded in element number 5 of record C of the DEM. 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.

DEM's 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.

Note: All LEVEL 1 DEMS have the potential of exhibiting systematic vertical elevation shifts (all within acceptable elevation tolerance) which may become apparent if contours are generated from the DEM and for analyses that make use of DEM derived slope data.

The following is an explanation of this processing artifact as describe by a USGS representative:

> Despite the 'corn rows' or striping artifacts found in the manually profiled DEMs, the data is good for most uses, dependent on how stringent or robust the modeling requirements are for the elevation data. The data was accurate for the 7meter and 15meter databases established at that time. The visual striping artifacts of these DEMs is a result of the profiling technique used in the photogrammetric collection process. The use of photogrammetric collection was defined as a "Level 1" DEM process that could have a vertical accuracy of 15m. Current methodology utilizes map contour data to make the DEM, and is defined as a "Level 2" DEM. Please consider the following possible limitations

of Level 1 DEMs:

1) Hydrologic Modeling - where surface flows are dependent on criteria for modeling i.e. 5 meters or less. (The profiled DEM is within the 7 meter accuracy with the methods used at that time.)

2) Use of slope and aspect - civil engineering (planning purposes).

3) Soil and vegetative studies.

4) The production of contours from a DEM conform to the row artifacts instead of providing a smooth transition.

5) Visual impact of the artifacts as depicted in a shaded relief.

The "striping" is caused by the manual profile method of collection which consisted of a person keeping a 'floating dot' on the ground of a stereo image in a East/West direction, where the floating dot tended to 'dig' in one direction and 'float' in the other.

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.

Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value:
Vertical_Positional_Accuracy_Explanation: RMSE of the DEM.

Lineage:
Source_Information: for USGS & USFS included DEMs
Source_Citation:
Citation_Information:
Originator: U.S. Geological Survey
Publication_Date:
Title: digital contour lines
Geospatial_Data_Presentation_Form: map
Publication_Information:
Publication_Place: Reston, VA
Publisher: U.S. Geological Survey
Type_of_Source_Media: magnetic tape
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 197907
Ending_Date: present
Source_Currentness_Reference: ground condition

Source_Citation_Abbreviation: CONTOUR1
Source_Contribution:
hypsographic vector information which is interpolated to regular grid posts to form DEM grids in 30- by 30- meter UTM data spacing within the 7.5 minute DEM bounds.

Source_Information: for USGS DEMs
Source_Citation:
Citation_Information:
Originator: U.S. Geological Survey
Publication_Date:
Title: photo ID number
Geospatial_Data_Presentation_Form: remote-sensing image
Publication_Information:
Publication_Place: Reston, VA
Publisher: U.S. Geological Survey
Type_of_Source_Media: transparency
Source_Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: various
Ending_Date: various
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: PHOTO1
Source_Contribution: elevation values

Source_Information: for USGS DEMs
Source_Citation:
Citation_Information:
Originator: U.S. Geological Survey
Publication_Date: Unpublished material
Title: project control
Geospatial_Data_Presentation_Form: map
Publication_Information
Publication_Place: Reston, VA
Publisher: U.S. Geological Survey
Type_of_Source_Media: magnetic tape
Source_Time_Period_of_Content:
Time_Period_Information
Range_of_Dates/Times:
Beginning_Date: various
Ending_Date: various
Source_Currentness_Reference: ground condition
Source_Citation_Abbreviation: CONTROL1
Source_Contribution: ground control points

Source_Information: for BLM only DEMs
Source_Citation:
Citation_Information:
Originator: Bureau of Land Management
Publication_Date: Unpublished material
Title: DEM
Geospatial_Data_Presentation_Form:
Publication_Information
Publication_Place:
Publisher:

Type_of_Source_Media: digital
Source_Time_Period_of_Content: 1993
Time_Period_Information
Range_of_Dates/Times:
Beginning_Date: 199304
Ending_Date: 199308
Source_Currentness_Reference:
Source_Citation_Abbreviation:
Source_Contribution: contour lines (Western Oregon Digital Database)

Process_Step:
Process_Description:
The production procedures, instrumentation, hardware and software used in the collection of standard U. S. Geological Survey (USGS) Digital Elevation Models (DEM's) vary depending on systems used at the contractor, cooperator or National Mapping Division (NMD) production sites. This process step describes, in general, the process used in the production of standard USGS DEM datasets.

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

Level 2 DEM: Level 2 DEM's are produced by converting 1:24,000-scale and 1:100,000-scale hypsography digital line graph (DLG) data to DEM format or the DEM's 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.

Level 3 DEM: Level 3 DEM's are created from DLG data that has been vertically integrated with all categories of hypsography, hydrography, ridge line, break line, drain files and all vertical and horizontal control networks. The production of level 3 DEMs requires a system of logic incorporated into the software interpolation algorithms that clearly differentiates and correctly interpolates between the various types of terrain, data densities and data distribution.

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 and edge joining: DEM datasets within a project area (consisting of a number of adjacent files) are edge match and edge join edited to assure terrain surface continuity between files. Edge matching is the process of averaging adjacent elevation values along common edges within a zone of approximately 5 row or column grid posts on both edges. When edge values exceed 3 elevation units difference, edge joining is performed. Edge joining is an extensive level of editing and requires editing elevation values internal to the DEM in order 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: DEM's are viewed on interactive editing systems to identify and correct blunder and systematic errors. DEM's 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.

Source_Used_Citation_Abbreviation: CONTOUR1, PHOTO1, CONTROL1

Process_Date:

Spatial_Data_Organization_Information

Direct_Spatial_Reference_Method: raster

Raster_Object_Information:

Raster_Object_Type: grid cell

Row_Count:

Column_Count:

Spatial_Reference_Information:

SOURCE DEMS

Horizontal_Coordinate_System_Definition:

Planar:

Grid_Coordinate_System:

Grid_Coordinate_System_Name: Universal Transverse Mercator

Universal_Transverse_Mercator:

UTM_Zone_Number: 10-19

Transverse_Mercator:

Scale_Factor_at_Central_Meridian: .09996

Longitude_of_Central_Meridian: depends on zone

Latitude_of_Projection_Origin: 0.0

False_Easting: 500000

False_Northing: 0.0
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: row and column
Coordinate_Representation:
Abscissa_Resolution: 30
Ordinate_Resolution: 30
Planar_Distance_Units: meters

Geodetic_Model:
Horizontal_Datum_Name: North American Datum 1927
Ellipsoid_Name: Clark 1866
Semi-major_Axis: 6378206.4
Denominator_of_Flattening_Ratio: 294.9787

Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Datum_Name: National Geodetic Vertical Datum of 1929
Altitude_Resolution: 1
Altitude_Distance_Units: feet or meters
Altitude_Encoding_Method:
explicit elevation coordinate included with horizontal coordinates

LATTICES

Horizontal_Coordinate_System_Definition:
Planar:
Grid_Coordinate_System:
Grid_Coordinate_System_Name: Oregon Lambert Conic Conformal
State Standard Projection
Lambert Conic Conformal:
(see http://www.sscgis.state.or.us/coord/project/gpl.html)

1st standard parallel: 43 00 00
2nd Standard parallel: 45 30 00
Longitude_of_Central_Meridian: -120 30 00
Latitude_of_Projection_Origin: 41 45 00
False_Easting: 400000 (meters)
False_Northing: 0.0
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method:
Coordinate_Representation:
Abscissa_Resolution: 98.425
Ordinate_Resolution: 98.425
Planar_Distance_Units: international feet

Geodetic_Model:
Horizontal_Datum_Name: North American Datum 1983
Ellipsoid_Name: GRS1980
Semi-major_Axis:
Denominator_of_Flattening_Ratio:

Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Datum_Name: National Geodetic Vertical Datum of 1929
Altitude_Resolution:

Altitude_Distance_Units: meters
Altitude_Encoding_Method:

Entity_and_Attribute_Information:

Metadata attributes: QUAD Specific Metadata

Refer to comma-delimited textfile (QUADMETA.TXT)
or DBASE file (QUADMETA.DBF). Pertinent source and
lattice metadata is combined in the one file.

Attributes: Fields & Definitions

fields

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC
1	OHIO_CODE	7	7	C	-
8	QUADNAME	30	30	C	-
38	PROVIDER	8	8	C	-
46	MAP_CTR	7	7	C	-
53	LEVEL	6	6	C	-
59	RMSE_VER	2	2	C	-
61	CELLSIZE	8	8	F	3
69	NCOLS	4	4	B	-
73	NROWS	4	4	B	-
77	E_BND_CRD	8	15	F	6
85	N_BND_CRD	8	16	F	7
93	W_BND_CRD	8	15	F	6
101	S_BND_CRD	8	16	F	7
109	MEAN	8	12	F	6
117	STDV	8	12	F	6
125	Z_MAX	8	16	F	7
133	Z_MIN	8	16	F	7
141	UTM_RAW	2	2	C	-
143	X_Y_UN_RAW	2	2	C	-
145	Z_UN_RAW	2	2	C	-
147	ORG_DATE	10	10	C	-
157	REV_DATE	10	10	C	-

ohio-code		(see above USGS catalog scheme)
quadname		(name of 7.5 min quad)
provider	*	(either USFS or USGS/BLM or BLM)
map_ctr	*	(Mapping Center -either EMC,WMC,MCMC,RMMC,GPM2,CONT or FS = USFS)
level	*	(Code 1=DEM-1 2=DEM-2 3=DEM-3)
rmse_ver	*	(7 = 7m RMSE, 15 = 15m RMSE)
cellsize		(standard cellsize in feet)
ncols		(number of columns)
nrows		(number of rows)
e_bnd_crd		(east bounding coordinate)
n_bnd_crd		(north bounding coordinate)
w_bnd_crd		(west bounding coordinate)
s_bnd_crd		(south bounding coordinate)

mean		(mean elevation)
stdv		(standard deviation)
z_max		(maximum elevation)
z_min		(minimum elevation)
utm_raw	*	(raw source DEM UTM zone; either 10 or 11)
x_y_un_raw	*	(raw source DEM x_y units; 1=feet 2=meters)
z_un_raw	*	(raw source DEM elevation unit; 1=feet 2=meters)
org_date	*	(raw source DEMs original generation date; YYMM two-digit year & two-digit month - if available)
rev_date	*	(raw source DEMs revision date; YYMM two-digit year & two-digit month - if available)

The level and rmse_version are specific to the quality of the DEM. Refer to the Data_Quality_Information/Process_Step section for the "level" field and the Data_Quality_Information/ Vertical_Positional_Accuracy section concerning the "rmse_version" field. In general, a 7 meter RMSE and a level 2 DEM are what are desirable in terms of the highest quality DEM. Several future USGS replacements for the 15m RMSE DEMs are already in progress.

(*) Metadata on the raw source DEMs is included with the lattice metadata.

Overview_Description: Source DEM Standards

Entity_and_Attribute_Overview:
The digital elevation model is composed of a 6-character integer raster representing a gridded form of a topographic map hypsography overlay. Each raster entity contains a 6-character integer value between -32,767 to 32,768.

Entity_and_Attribute_Detail_Citation:

U.S.Department of the Interior, U.S. Geological Survey, 1992, Standards for digital elevation models: Reston, VA,

A hypertext guide for 7.5min DEMs is available at:
<http://edcwww.cr.usgs.gov/glis/hyper/guide/7_min_dem>

Softcopies in ASCII format on the main DEM guide and standards is available at:
<ftp://www-nmd.usgs.gov/pub/ti/DEM/demstnds>
<ftp://www-nmd.usgs.gov/pub/ti/DEM/demguide>

Distribution_Information:
Distributor:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization:

Oregon State Service Center for GIS - DAS/IRMD
Contact_Address:
Address_Type: mailing address
Address: 155 Cottage St. NE
City: Salem
State_or_Province: OR
Postal_Code: 97310
Contact_Voice_Telephone: 503 378 4583
Hours_of_Service: 8:00AM - 6:30PM Tu->Fr
Contact_Instructions: E-Mail: C.Fred.WEIGMAN@state.or.us
WebPage: http://www.sscgis.state.or.us

Resource_Description: 7.5-minute digital elevation data

Distribution_Liability:
Although these data have been processed successfully on a
computer system at the SSCGIS, no warranty (expressed or implied)
is made by the SSCGIS regarding the utility of the data on any
other system, nor shall the act of distribution constitute any
such warranty. SSCGIS will warrant the delivery of this product
in computer-readable format.

Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Format_Name: DEM
Format_Information_Content:

USGS standard DEM:
The standard USGS DEM can be described as an
ASCII formatted elevation file preceded by a
metadata header file which consists of one 1024
byte ACSII record (a single record).

Transfer_Size: 1
Digital_Transfer_Option: CD or anonymous FTP
Offline_Option:
Offline_Media:
Recording_Format:
Compatibility_Information: none

Products:
Combined digital CD product = $30.

The online copy of the data set is available for free via anonymous
FTP ftp.sscgis.state.or.us; under /pub/data/baseline97.

Metadata_Reference_Information:

Metadata_Date: 199704
Metadata_Contact: E-Mail: C.Fred.WEIGMAN@state.or.us
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: Oregon State Service Center for GIS - DAS/IRMD

Contact_Address:
Address_Type: mailing address
Address: 155 Cottage St. NE
City: Salem
State_or_Province: OR
Postal_Code: 97310
Contact_Voice_Telephone: 503 378 4583
Metadata_Standard_Name: Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: 19940608