GEOSAT Radar Altimeter DEM Atlas of Antarctica North of 72.1 degrees South, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Ute Christina Herzfeld, Michael S. Matassa 1999. *GEOSAT Radar Altimeter DEM Atlas of Antarctica North of 72.1 degrees South, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center.

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FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0075

National Snow and Ice Data Center

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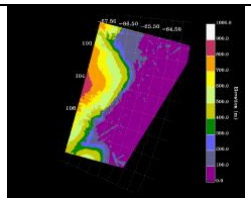
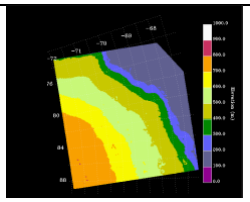
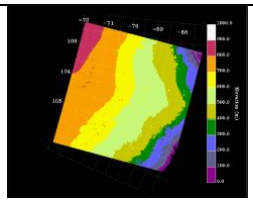
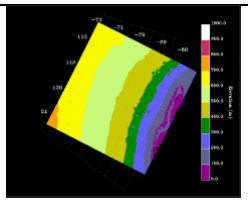
1 DATA DESCRIPTION

1.1 Parameters

			
>63 to 68 degrees south 97 to 113 degrees east	>67 to 72 degrees south 73 to 89 degrees east	>67 to 72 degrees south 97 to 113 degrees east	>67 to 72 degrees south 109 to 125 degrees east

1.1.1 Sample Data Record

UTM version

Table 1. Column Headings for UTM Data

1		E-W UTM coordinate
2		N-S UTM coordinate
3		Elevation value for grid node defined by columns 1 and 2

```
233000.   -7.05900E+06   -1.30000
239000.   -7.05900E+06   -1.83622
242000.   -7.05900E+06   -1.97845
245000.   -7.05900E+06   -2.11752
248000.   -7.05900E+06   -2.11752
251000.   -7.05900E+06   -2.25113
254000.   -7.05900E+06   -2.33926
257000.   -7.05900E+06   -2.34469
260000.   -7.05900E+06   -2.64000
200000.   -7.06200E+06   -1.16000
```

Latitude/Longitude version:

Table 2. Column Headings for Lat/Lon Data

1		Latitude
2		Longitude
3		Elevation value for grid node defined by columns 1 and 2

```
-63.559808      99.621068   -1.30000
-63.564277      99.741325   -1.83622
-63.566474      99.801469   -1.97845
-63.568646      99.861624   -2.11752
```

-63.570793	99.921789	-2.11752
-63.572914	99.981964	-2.25113
-63.575010	100.042149	-2.33926
-63.577081	100.102343	-2.34469
-63.579127	100.162548	-2.64000
-63.560204	98.954757	-1.16000

1.2 Discussion

Although the importance of Antarctica in the global system has long been recognized and discussed in the literature, data as basic as topographic maps of a resolution amenable to geophysical analysis are still lacking for large parts of Antarctica. This investigation adds to the knowledge of Antarctica by using the improved evaluation of satellite altimetry from the GEOSAT Geodetic Mission to build a more accurate atlas of Antarctica north of 72.1 degrees south.

The quality and detail of the maps in this data set makes them particularly useful to scientists for:

- documenting more ice margin details.
- showing ice drainage areas and troughs.
- identifying ice shelves.
- studying ice dynamics and changes in Antarctic ice-stream and ice-shelf systems.
- correcting satellite images for effects of slope and elevation.

The kriging method used in producing this atlas would also be applicable to future altimetry data and therefore will facilitate monitoring the changes in the ice streams and ice-surface elevation that are critical for a determination of mass balance and stability of the Antarctic Ice Sheet.

1.3 File Information

1.3.1 Format

The data for the UTM coordinates are stored a file called dtm.tar, which contains 28 files compressed by the UNIX gzip compression utility. Each file is named for the map area it covers. For example, the file named "m69e61_77n67_721.g.dtm.gz" contains data for the map area with central meridian of 69 degrees bounded east-west between 61.0 and 77.0 degrees and bounded north-south between -67.0 and -72.1 degrees.

The files are in ASCII format and contain the following 3 tab-delimited columns:

Table 3. ASCII Format Tab-Delaminated Columns

1		E-W UTM coordinate
2		N-S UTM coordinate
3		elevation value for grid node defined by columns 1 and 2

The data for latitude and longitude coordinates are stored in a file called dtm-11.tar. The files are in ASCII format and contain the following 3 tab-delimited columns:

Table 4. Explanation of Location Data

1		Latitude
2		Longitude
3		Elevation value for grid node defined by Columns 1 and 2

1.3.2 Grid Description

For the atlas, the Antarctic is divided into rows of map sheets (72.1 degrees to 67 degrees south; 68 degrees to 63 degrees south).

Table 5. Map Sheet Parameters

Row (degrees)	East Min. (UTM)	East Max. (UTM)	North Min. (UTM)	North Max. (UTM)	No. of grid nodes E-W	No. of grid nodes N-S	Map Size (km) E-W	Map Size (km) N-S
67 - 72.1	227000	773000	-7998000	-7455000	183	182	546	543
63 - 68	167000	833000	-7542000	-7011000	223	178	666	531

Each of the 28 maps covers 16 degrees of longitude and overlaps two degrees with the maps on either side, so each map center is offset from the next one by 12 degrees of longitude. The map names (e.g., m69e61-77n721-67) give central meridian (69 degrees) and extent of the nominal map area (61 degrees to 77 degrees east, 72.1 degrees to 67 degrees). All the maps use the same projection with respect to the central meridian, and maps in the same row are the same size. For Antarctica, east coordinates always have six digits, while north coordinates have seven.

The files for the UTM coordinates are stored in the dtm.tar file which expands to the dtm directory. The files for the latitude and longitude coordinates are stored in the dtm-ll.tar file which expands to the dtm-ll directory.

1.3.3 Atlas Maps by Name and Coordinates

The 28 Antarctic Atlas Maps are listed below with the coordinates and name of each map.

Table 6. Atlas Maps Description

Coordinates			Map Name
Central Meridian	**East Coordinates**	**South Coordinates**	
45	37 to 53	63 to 68	Casey Bay
57	49 to 65	63 to 68	Napier Mountains
69	61 to 77	63 to 68	Mawson Coast East
81	73 to 89	63 to 68	Leopold and Astrid Coast
93	85 to 101	63 to 68	Queen Mary Coast
105	97 to 113	63 to 68	Knox Coast
117	109 to 125	63 to 68	Sabrina Coast
129	121 to 137	63 to 68	Claire Coast
141	133 to 149	63 to 68	Adelie Coast
153	145 to 161	63 to 68	Ninnis Glacier Tongue
297	289 to 305	63 to 68	Antarctic Peninsula (Graham Land)
15W	23W to 7W	67 to 72.1	Ekstrom Ice Shelf
3W	11W to 5	67 to 72.1	Fimbul Ice Shelf
9	1 to 17	67 to 72.1	Princess Astrid Coast
21	13 to 29	67 to 72.1	Erskine Iceport
33	25 to 41	67 to 72.1	Riiser-Larsen Peninsula
45	37 to 53	67 to 72.1	Prince Olav Coast
57	49 to 65	67 to 72.1	Mawson Coast West
69	61 to 77	67 to 72.1	Lambert Glacier
81	73 to 89	67 to 72.1	Ingrid Christensen Coast
93	85 to 101	67 to 72.1	Wilkes Land e85to101
105	97 to 113	67 to 72.1	Wilkes Land e97to113
117	109 to 125	67 to 72.1	Wilkes Land e109to125
129	121 to 137	67 to 72.1	Wilkes Land e121to137
141	133 to 149	67 to 72.1	Wilkes Land e133to149
153	145 to 161	67 to 72.1	Cook Ice Shelf
165	157 to 173	67 to 72.1	Pennell Coast
292	284 to 300	67 to 72.1	Antarctic Peninsula (Palmer Land)

1.3.4 Data Source

The data originate from the GEOSAT Geodetic Mission. Refer to the radar altimeter document for more information about the instrument.

1.3.5 Data Granularity

A general description of data granularity as it applies to the IMS appears in the EOSDIS Glossary. The data granularity for this data set is one map for every 16 degrees of longitude.

1.3.6 Data File Size (in compressed tar file format):

File with UTM coordinates (dtm.tar.gz)	8.0 MB
File with latitude and longitude coordinates (dtm-ll.tar.gz)	11.68 MB

Unit of Measurement: UTM coordinates - meters [m]

1.4 Spatial Information

1.4.1 Coverage

This data set covers all of Antarctica from 60 degrees south to 72.1 degrees south at a resolution of three kilometers.

1.4.2 Geolocation

The data were mapped using the Universal Transverse Mercator (UTM) Projection (Snyder, 1987). Data are stored as UTM coordinates and as latitude and longitude coordinates. The southern hemisphere UTM coordinates are negative numbers.

1.5 Temporal Information

1.5.1 Coverage

The data points for this data set were collected by the radar altimeter on the GEOSAT satellite from March, 1985 to September, 1986.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

The data were collected during the GEOSAT Geodetic Mission by a radar altimeter.

2.2 Processing

Satellite radar altimeters measure the time it takes an electromagnetic signal to travel from the altimeter antenna to the ice sheet surface and back to the altimeter's receiver. This "range measurement" allows investigators to determine the satellite's height above the ice sheet. NSIDC's Radar Altimeter document describes the instrument and how it works.

Corrections are applied to the range measurements to account for the fact that returns are different over ice than over the ocean. The correction for interpreting the data over ice is called "retracking," and is described in papers by Davis and Zwally (1993), and Zwally, et al. (1983).

Over sloping terrain, the radar altimeter measurement needs to be corrected because the return comes from a point not directly below the satellite, but to the uphill side. The elevation indicated by the return time in this case is higher than that directly below the satellite. The data are slope-corrected to reduce the errors, using the slope correction algorithm from Brenner et al. (1983).

For this data set, elevations were derived from the slope-corrected data and grid values were calculated using a geostatistical technique (Herzfeld et al. 1993) and individual atlas pages were created using UTM coordinates. The Universal Transverse Mercator (UTM) Projection (Snyder 1987) compensates for the distortion of areas far away from the central meridian.

After the UTM coordinates were calculated, the data were gridded using ordinary kriging with search algorithms developed for geographical track-line data (Herzfeld et al. 1993 and Journel and Huijbregts 1978). The particular kriging algorithm used for this data are described in Herzfeld (1990).

Map sheets were overlapped by two degrees to ensure that each point of Antarctica is contained in at least one map.

The UTM coordinates were converted to latitude and longitude coordinates after the data was gridded.

2.3 Quality, Errors, and Limitations

The maps are not accurate in mountainous terrain but are sufficiently accurate to determine surroundings and general shape of small glaciers.

Limitations of the Data: Orbital coverage of the GEOSAT Geodetic Mission did not extend to the poles.

Known Problems with the Data: Some offshore contours are caused by ice shelves and ice islands. Contour lines that resemble ground-track patterns may be artifacts, or may occur when there is over-representation of isolated higher elevations in regions of generally low relief, such as islands or larger ice bergs in the sea.

3 RELATED DATA SETS

- SEASAT and GEOSAT Altimetry Data for the Antarctic and Greenland Ice Sheets

4 CONTACTS AND ACKNOWLEDGMENTS

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5 REFERENCES

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6 DOCUMENT INFORMATION

6.1 Publication Date

July 199

6.2 Date Last Updated

24 May 2021