MEaSUREs Antarctic Boundaries for IPY 2007-2009 from Satellite Radar, Version 1

USER GUIDE

How to Cite These Data

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

Mouginot, J., E. Rignot, and B. Scheuchl. 2016. *MEaSUREs Antarctic Boundaries for IPY 2007-2009 from Satellite Radar, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/SEVV4MR8P1ZN. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/nsidc-0709

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

The data set is an integrated product that provides detailed mappings of the location of the Antarctic Ice Sheet grounding line, ice shelf pinning points (e.g. nunataks, ice rises, and ice rumples and denoted by the attribute "Islands" in the Ice Boundaries shapefile), and the coastline. This product can be used as a mask to define grounded ice, floating ice and/or the Antarctic coastline. The primary attributes for each shapefile are listed below in Table 1.

Table 1. Primary Data Attributes for Shapefiles

File Name	Data Field	Description
Coastline_Antarctica	Name	ocean
GroundingLine_Antarctica	Name	grounded ice
IceBoundaries_Antarctica	Name	Names for Antarctic floating glacial ice (ice shelves and ice tongues), single label for all grounded ice, single label for all islands
IceShelf_Antarctica	Name	Names for Antarctic floating glacial ice (ice shelves and ice tongues)

The coding for the GeoTIFF raster is:

- 0 for the ocean
- 125 for the floating glacial ice (ice shelves and ice tongues)
- 255 for the grounded ice

To view a sample of the data, refer to the Spatial Coverage section, Figure 1.

1.2 File Information

1.2.1 Format

This data set consists of four ESRI shapefiles and a raster mask provided in GeoTIFF (.tif) and bitmap (.bmp) format.

The ESRI shapefiles consist of five file types:

- .shp – main file that stores the feature geometry
- .shx – index file that stores the index of the feature geometry
- .dbf – dBASE table that stores the attribute information of features
- .prj – file that stores the coordinate system information

- .cpg – optional file that specifies the code page for identifying the character set to be used

The raster image is a 500 m resolution mask of Antarctica that includes the boundaries, grounding line, coastline, and ice shelves described in the shapefiles.

1.2.2 Directory Structure

Data are available via FTP and HTTPS.

This directory contains the following folders:

Table 2. Top-Level FTP Directory Structure

Folder Name	Description
IceBoundaries_Antarctica	merged shapefile product that represents the coastline, floating glacial ice (ice shelves and ice tongues), and grounded ice
IceShelf_Antarctica	floating glacial ice (ice shelves and ice tongues) boundaries shapefile
Coastline_Antarctica	coastline shapefile
GroundingLine_Antarctica	grounded ice (grounding line) shapefile
Mask_Antarctica	GeoTIFF and bitmap files containing the ice shelf mask

1.2.3 Naming Convention

This section describes the file naming convention for this data set (Table 3).

Example:
IceShelf_Antarctica_v1.shp
IceShelf_Antarctica_v1.cpg
IceShelf_Antarctica_v1.dbf
IceShelf_Antarctica_v1.prj
IceShelf_Antarctica_v1.shx

Naming Convention: XXXXXXXXXX_Antarctica_v1.ext

Table 3. Naming Convention

Variables	Description
XXXXXXXXXX	Type of data: CoastLine GroundingLine IceBoundries IceShelf Mask
Antarctica	Geographic location

Variables	Description
V1	Version 1
.ext	File type: .cpg .dbf .prj .shp .shx .tif .bmp

1.2.4 File Size

The shapefiles in this data set range from 480 KB to 1,788 KB. The GeoTIFF (.tif) raster mask is 2,240 KB, and the bitmap (.bmp) raster mask is 119.7 MB.

1.2.5 Volume

Total volume of the data set is 127 MB.

1.3 Spatial Information

1.3.1 Coverage

The data provide an outline for 1,553,978 km^2 of Antarctic Ice Shelves (floating glacier ice) or 99.52 percent of the total ice shelf area for Antarctica (Rignot et al. 2013).

Southernmost Latitude: 90° S
Northernmost Latitude: 60° S
Westernmost Longitude: 180° W
Easternmost Longitude: 180° E

1.3.1.1 Spatial Coverage Maps

The Antarctic raster mask (Figure 1) includes floating ice, grounded ice, and ocean as per the coding for the GeoTIFF raster following Table 4. Figure 2 shows spatial coverage for each shapefile in the data set.

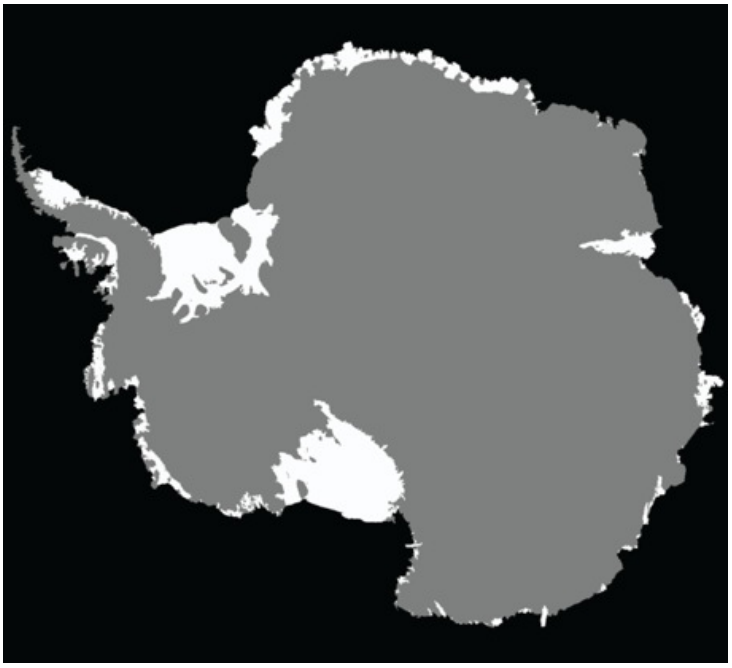

Figure 1. Antarctic Raster Mask

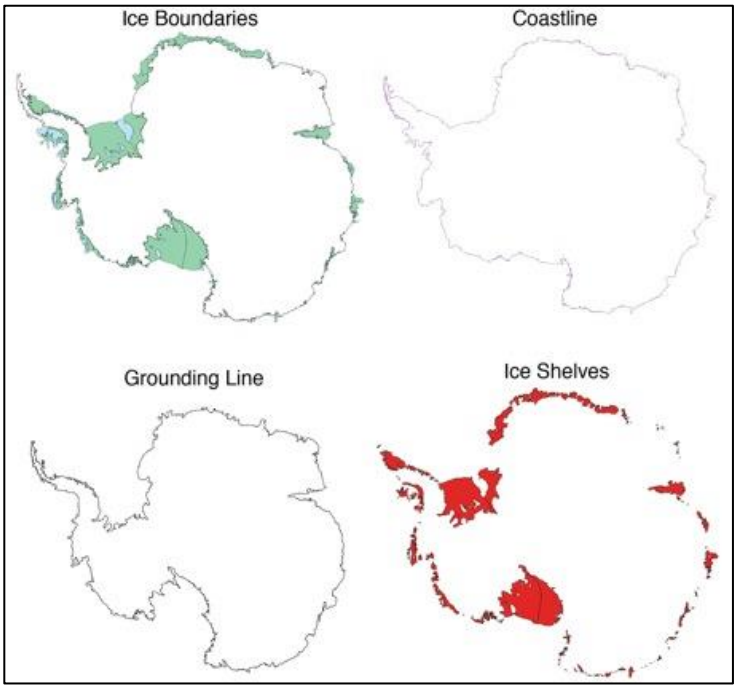

Figure 2. Shapefile Spatial Coverage Maps

1.3.2 Resolution

Spatial resolution varies for each sensor. See Table 4 for the associated approximate resolutions.

Table 4. Spatial Resolution by Satellite/Sensor

Satellite/Sensor	Resolution
ERS-1, ERS-2	~50 m
RADARSAT-1	~35 m
RADARSAT-2	~46 m
ALOS PALSAR	~120 m
COSMO SkyMed	~25 m
Sentinel-1A	~50 m

1.3.3 Projection

The shapefiles and GeoTIFF file are provided in Polar Stereographic projection ESPG:3031.

1.4 Temporal Information

1.4.1 Coverage

Data for InSAR grounding lines were obtained from multiple satellites between 1992 and 2014, for which the newest grounding line position was used. Specifically, for the Amundsen Sea Sector, data from 2011 was used. The data for the coastline mapping were acquired in 2008 and 2009.

1.4.2 Resolution

22 years (264 months).

2 DATA ACQUISITION AND PROCESSING

2.1 Background

The ice front can be determined from SAR satellite imagery. The grounding line refers to the location where an ice sheet detaches from the bedrock and starts floating in the ocean. This data set includes ice front and grounding line information for the entire Antarctic coastline, derived from a variety of satellite radar interferometry data. Mapping of the different boundaries was realized with QGIS v2.12.

2.2 Acquisition

Grounding lines for the Antarctic Ice Sheet were derived using differential satellite synthetic aperture radar interferometry (DInSAR) data from the Earth Remote Sensing Satellites 1 and 2 (ERS-1 and -2), RADARSAT and RADARSAT-2, and the Advanced Land Observing System (ALOS) PALSAR for years 1992 to 2009. Ice front information was extracted from ALOS PALSAR data acquired during IPY in 2008 and 2009. A detailed description of the product and the methodology is provided in Rignot et al. 2011.

2.3 Data Sources

See MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry for details on grounding line acquisitions. Ice front data (coastline) were determined from ALOS/PALSAR and ENVISAT/ASAR amplitude images acquired in 2008 and 2009. See Rignot, et al. 2013 for more details.

2.4 Quality, Errors, and Limitations

2.4.1 Quality Assessment

A detailed description of the product and its quality is provided in Rignot et al. 2013. Details about grounding line position are provided in MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry user guide. We estimate that the coastline is mapped with a precision of about 300 m and is based on geocoded SAR amplitude images from ALOS/PALSAR and ENVISAT/ASAR geocoded at spacing of 150 m.

In some places, coastline and grounding line are evolving rapidly, and as a result, this dataset may not represent the current state. In addition, a few pinning points may be still missing.

Based on QGIS software, the shapefiles should be free of geometry errors; i.e. shapes should not overlap or intersect.

2.5 Instrumentation

2.5.1 Description

For information about the SAR systems used to construct the mosaics from which this data set is derived, see SAR Datasets / RADARSAT-1 | Alaska Satellite Facility, ERS - Earth Online - ESA , and About ALOS - PALSAR.

3 SOFTWARE AND TOOLS

Shapefiles can be readily accessed using GIS software such as ArcGIS and QGIS.

4 RELATED DATA SETS

ICESat-Derived Grounding Zone for Antarctic Ice Shelves
MEaSUREs InSAR-Based Antarctica Ice Velocity Map
MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry

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6 REFERENCES

Li, X., E. Rignot, M. Morlighem, J. Mouginot, and B. Scheuchl. 2015. Grounding line retreat of Totten Glacier, East Antarctica, 1996 to 2013. Geophysical Research Letters 42: 8049–8056. doi: 10.1002/2015GL065701.

Rignot, E., J. Mouginot, M. Morlighem, H. Seroussi, and B. Scheuchl. 2014. Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith, and Kohler glaciers, West Antarctica, from 1992 to 2011. *Geophysical Research Letters* 41: 3502–3509. doi: 10.1002/2014GL060140.

Rignot, E., S. Jacobs, J. Mouginot, and B. Scheuchl. 2013. Ice-shelf melting around Antarctica. *Science* 341(6143): 266-270. doi: 10.1126/science.1235798.

Rignot, E., J. Mouginot, and B. Scheuchl. 2011. Antarctic grounding line mapping from differential satellite radar interferometry. *Geophysical Research Letters* 38(10): L10504. doi: 10.1029/2011GL047109.

Rignot, E. 1996. Tidal flexure, ice velocities and ablation rates of Petermann Gletscher, Greenland. *Journal of Glaciolology* 42(142): 476-485.

Rignot, E. 1998. Hinge-line migration of Petermann Gletscher, north Greenland, detected using satellite-radar interferometry, *Journal of Glaciolology* 44(148): 469-476.

— Radar Interferometry Detection of Hinge-Line Migration on Rutford Ice Stream and Carlson Inlet, Antarctica. *Annals of Glaciology* 27: 25-32.

Rignot, E., L. Padman, D. R. MacAyeal, and M. Schmeltz. 2000. Observations of ocean tides below the Filchner and Ronne Ice Shelves, Antarctica, using synthetic aperture radar interferometry: Comparison with tide model predictions. *Journal of Geophysical Research - Oceans* 105(C8): 19,615-19,6130.

Rignot, E. 2002. East Antarctic Glaciers and Ice Shelves Mass Balance from Satellite Data. *Annals of Glaciology* 34: 217-227.

Schmeltz, M., E. Rignot, and D. McAyeal. 2001. Ephemeral grounding as a signal of ice-shelf change. *Journal of Glaciology* 47(156): 71-77.

7 DOCUMENT INFORMATION

7.1 Publication Date

October 2016

7.2 Date Last Updated

04 November 2016