MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry, Version 2

USER GUIDE

How to Cite These Data

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

Rignot, E., J. Mouginot, and B. Scheuchl. 2016. *MEaSUREs Antarctic Grounding Line from Differential Satellite Radar Interferometry, Version 2*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/IKBWW4RYHF1Q. [Date Accessed].

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National Snow and Ice Data Center

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1 DETAILED DATA DESCRIPTION

1.1 Format

ESRI ArcGIS Shapefile:

- .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

This data set also contains an XML file (.xml), which contains additional metadata.

1.2 File Naming Convention

Example file name:
InSAR_GL_Antarctica_v02.shp

Files are named according to the following convention, which is described in Table 1:
InSar_GL_Antarctica_v02.xxx

Table 1. File Naming Convention

Variable	Description
InSAR	SAR Interferometry
GL	Grounding Line
Antarctica	Geographic location
v02	Data Set Version
.xxx	File type

1.3 File Size

The character set code (.cpg) and projection (.prj) files are 1 KB each. The index file (.shx) is 2 KB, and the dBASE table is 29 KB. The shapefile (.shp) is 11,028 KB.

The total volume of the data set is approximately 10.8 MB.

1.4 Spatial Coverage

The data cover roughly 75% of the Antarctic grounding line (the transition from grounded ice to floating ice sheet). The grounding lines of ice-covered offshore islands are partially covered. Lines are discontinuous, and in some areas multiple picks from different SAR missions and dates are shown. Most of the fast-flowing, large-flux outlet glaciers and ice streams are mapped. Spatial coverage for the data is shown in Figure 1 and is defined by the following boundaries:

- Southernmost latitude: 90° S
- Northernmost latitude: 60° S
- Westernmost longitude: 180° W
- Easternmost longitude: 180° E

Spatial Coverage Map

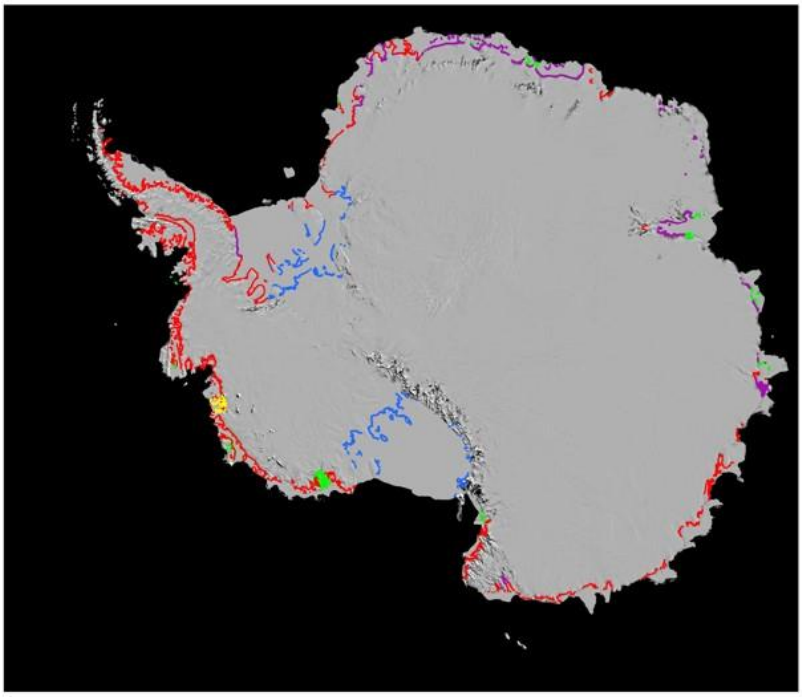

Figure 1. Delineation of Antarctic grounding lines with satellite radar interferometry (DInSAR) from ERS-1 and ERS-2 (red), RADARSAT-1 (purple), RADARSAT-2 (blue), ALOS PALSAR (green), Copernicus Sentinel-1A (yellow), COSMO Skymed (cyan) overlaid on the Moderate Resolution Imaging Spectroradiometer (MODIS) mosaic of Antarctica.

1.4.1 Projection and Grid Description

The data are provided in geographic latitude and longitude as defined by the WGS-84 datum.

1.4.2 Spatial Resolution

Spatial resolution varies for each satellite/sensor. See Table 2 for the associated resolutions.

Table 2. Spatial Resolution

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

1.5 Temporal Coverage

07 February 1992 and 17 December 2014

The ata were obtained from multiple satellites during this time period. The satellites, collection years, and regions are listed in Table 4.

1.6 Parameter or Variable

Detailed mappings of the geometric position of the Antarctic Ice Sheet grounding line, derived from satellite data, are provided. The parameter is comprised of latitude, longitude, satellite/sensor, and up to four orbits and acquisitions dates (see Table 3 for more information).

1.6.1 Parameter Description

Table 3. Parameter Attributes Description

Attribute	Description
Satellite/Sensor	Satellites/Sensors used for this product include: ERS: European Space Agency Earth Remote Sensing Satellites 1 and 2 RSAT: RADARSAT-1 — Canadian Space Agency Synthetic Aperture Radar Satellite R2: RADARSAT-2 — Canadian Space Agency Synthetic Aperture Radar Satellite PALSAR: Japan Aerospace Exploration Agency Advanced Land Observing System (ALOS) Phased Array type L-band Synthetic Aperture Radar COSMO SkyMed: Italian Space Agency Synthetic Aperture Radar Constellation Sentinel-1A: European Union and European Space Agency Copernicus program Synthetic Aperture Radar Satellite
Orbit	Sensor orbits: unique identifiers for the data used to generate the grounding lines
Date	Data acquisition dates

2 SOFTWARE AND TOOLS

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

3 DATA ACQUISITION AND PROCESSING

3.1 Data Acquisition Methods

Grounding lines for the Antarctic Ice Sheet were derived using differential satellite synthetic aperture radar interferometry (DInSAR) data for the years 1992 to 2014 from the Earth Remote Sensing Satellites 1 and 2 (ERS-1 and ERS-2), RADARSAT and RADARSAT-2, the Advanced Land Observing System (ALOS) PALSAR, COSMO Skymed, and Sentinel-1A. Two interferograms are required to perform differential interferometry. This requires a minimum of three consecutive acquisitions from a single sensor. In some cases, two sets of two consecutive acquisitions were used to generate the grounding line. In the case of the ERS-1/ERS-2 Tandem mission, two Tandem interferograms (four acquisitions) were used for grounding line detection. A detailed description of the product and the methodology is provided in Rignot et al. (2011).

Data Sources

Table 4 lists the temporal and spatial coverages for each satellite sensor used in this data set.

Table 4. Parameters by Source Satellite

Parameter	ERS-1, ERS-2	RADARSAT-1	RADARSAT-2	ALOS Palsar	COSMO SkyMed	Sentinel-1
Temporal coverage	1992, 1994-1996, 1999, 2000	2000	2009	2007, 2008	2013	2014
Mode*	N/A	F1	S5	FBS	Himage Polarimetric	Interferometric Wide
Incidence Angle	23°	38.5°	41.45°	39°	40.3°	32.3°
Number of Range Looks (Interferogram)	2	4	2	12	10	20
Number of Azimuth Looks (Interferogram)	10	5	6	30	10	2
Range pixel spacing (resolution)	8 (13.5 m)	5.3 (5.9 m)	11.8 (13.5 m)	4.7 (7.5 m)	3 (<3 m)	3 (2.3 m)
Azimuth pixel spacing (resolution)	4 (5 m)	4.6 (6.9 m)	5.3 (7.7 m)	3.3 (4 m)	3 (<3 m)	22(17.4 m)

*For more information on the modes of the different satellite sensors, see the following websites: RADARSAT-1, RADARSAT-2, ALOS PALSAR, COSM-SKMED, and Sentinel-1.

Quality Assessment

A detailed description of the product and its quality is provided in Rignot et al. (2011). Multiple mappings, instruments, and epochs were compared to estimate the positional accuracy. The standard error is ±100 m, with greater geolocation variations locally. In some cases, large (km) short-term and long-term migrations are present. The quality of the grounding line mapping depends on the satellite data used, the length of the interferometric baseline (short baselines yield more accurate positioning), the amplitude of the differential tides, phase coherence (high phase coherence means less noise), and the frequency of revisits. Short revisit times are most crucial in order to measure the grounding line in some regions of fast flow (e.g., Pine Island Glacier). See below for a list of satellites in order of accuracy, with the lowest accuracy listed first and the highest listed last.

- Sentinel 1-A (scansar)
- ALOS PalSAR (P-band, lower frequency)
- ERS-1,-2, Radarsat-1,-2 (C band)
- COSMO Skymed (X band)

3.2 Sensor or Instrument Description

For information about the SAR systems used to construct the mosaics from which this data set is derived, see the Canadian Space Agency's RADARSAT-1 web page, the European Space Agency's ERS-1/2 mission site, the Japan Aerospace Exploration Agency's About ALOS - PALSAR web page, the COSMO-Skymed website, and the European Space Agency's Copernicus Sentinel-1 web page.

4 REFERENCES AND RELATED PUBLICATIONS

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

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

4.1 Related Data Collections

- ICESat-Derived Grounding Zone for Antarctic Ice Shelves
- MEaSUREs InSAR-Based Antarctica Ice Velocity Map
- MEaSUREs InSAR-Based Ice Velocity Maps of Central Antarctica: 1997 and 2009
- MEaSURES Antarctic Boundaries for IPY 2007-2009 from Satellite Radar

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- ALOS PALSAR: Japan Aerospace Exploration Agency (JAXA)
- ERS-1, ERS-2: European Space Agency (ESA)
- RADARSAT, RADARSAT-2: Canadian Space Agency (CSA)
- Sentinel-1A: Copernicus/European Space Agency (ESA)
- COSMO SkyMed: Italian Space Agency (ASI)

The data set contains modified Copernicus Sentinel data (2014), acquired by the European Space Agency, distributed through the Alaska Satellite Facility, and processed by E. Rignot, J. Mouginot, and B. Scheuchl.

Data acquisitions between 2006 and 2009 are courtesy of the International Polar Year (IPY) Space Task group; thereafter, acquisitions were coordinated by the successor organization, the Polar Space Task Group.

6 DOCUMENT INFORMATION

6.1 Document Creation Date

October 2016

6.2 Document Revision Date

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