



MEaSURES Annual Greenland Outlet Glacier Terminus Positions from SAR Mosaics, Version 2

USER GUIDE

How to Cite These Data

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

Joughin, I., T. Moon, J. Joughin, and T. Black. 2021. *MEaSURES Annual Greenland Outlet Glacier Terminus Positions from SAR Mosaics, Version 2*. [Indicate subset used]. Boulder, Colorado USA.

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FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NSIDC-0642>



National Snow and Ice Data Center

TABLE OF CONTENTS

1	DATA DESCRIPTION.....	2
1.1	Parameters	2
1.1.1	Parameter Description.....	2
1.1.2	Sample Data Record	4
1.2	File Information	5
1.2.1	Format	5
1.2.2	File Naming Convention	5
1.3	Spatial Information	6
1.3.1	Coverage.....	6
1.3.2	Resolution.....	6
1.3.3	Geolocation	6
1.4	Temporal Information.....	7
1.4.1	Coverage.....	7
1.4.2	Resolution.....	7
2	DATA ACQUISITION AND PROCESSING	7
2.1	Acquisition	7
2.2	Derivation Techniques and Algorithms	7
2.3	Quality, Errors, and Limitations	8
2.4	Instrumentation	8
2.4.1	Description.....	8
3	VERSION HISTORY	8
4	RELATED DATA SETS	9
5	CONTACTS AND ACKNOWLEDGMENTS.....	9
5.1	Investigators.....	9
5.2	Acknowledgements.....	10
6	REFERENCES	10
7	DOCUMENT INFORMATION.....	10
7.1	Publication Date.....	10
7.2	Date Last Updated	10

1 DATA DESCRIPTION

This data set consists of annual, digitized (polyline) ice front positions for 239 outlet glaciers in Greenland. Ice front positions are derived from Sentinel-1A, Sentinel-1B, and RADARSAT-1 synthetic aperture radar (SAR) mosaics, plus imagery from Landsat 1 through Landsat 5 and Landsat 7 and Landsat 8. Although temporal coverage varies by glacier, data are available for the winter seasons 1972–1973 through 2020–2021.

1.1 Parameters

1.1.1 Parameter Description

Data are provided as annual shapefiles. Each shapefile contains all the available ice front (terminus) positions for that winter season, digitized as polylines. A separate glacier ID shapefile is provided that contains point locations and names for all glaciers in the data set. Table 1 and Table 2 describe the attributes that are included in the termini shapefiles and the glacier ID shapefile, respectively:

Table 1. Attributes For Ice Front Location (Termini) Shapefiles

Attribute	Description	Values
Glacier_ID	Numerical ID for each glacier across all data sets	1 – 239
Quality_FI	Quality flag	0. no flag 1. terminus position estimated or uncertain (see Section 2.3) 2. position uncertainty improved or verified using Landsat imagery 3. Landsat-7 scan-line corrector (SLC) failure affected digitization.
Image_ID	Unique identifier for image used to digitize terminus position	See Table 3. Naming Convention For Image_ID Attribute”
Sensor	Satellite source of image used to digitize terminus position	LC08 – Landsat-8 LE07 – Landsat-7 RAD1 – Radarsat-1 SEN1 – Sentinel-1
SourceDate	Year, month, and day of image used to digitize terminus position	YYYY-MM-DD

Table 2. Attributes For Glacier ID Shapefile

Attribute	Description	Values
GlacierID	Numerical ID for each glacier (used consistently across all data sets)	1 – 239
POINT_X	X-coordinate, glacier point location	See “Table 4. Geolocation Details”
POINT_Y	Y-coordinate, glacier point location	
GrnIndcNam	Greenlandic glacier name	Values are standardized to match "New Greenlandic" attribute in database of Greenland glacier names (Bjørk et al., 2015).
Official_n	Officially recognized glacier name	Values are standardized to match “Official_n” attribute in database of Greenland glacier names (Bjørk et al., 2015).
AltName	Alternative glacier name	Includes e.g., foreign name or Old Greenlandic name (Bjørk et al., 2015), or other recognized names.

The following table describes the naming conventions in the Image_ID attribute (the source images used to digitize glacier terminus positions):

Table 3. Naming Convention For Image_ID Attribute

Satellite	ID Naming Convention
Sentinel-1 ¹	SEN1_NSIDC_0723_Vx_YYYYMMDD_yyyymmdd x – Sentinel mosaic version YYYYMMDD – mosaic start date yyyymmdd – mosaic end date
RADARSAT-1 ²	RAD1_NSIDC_0633_Vxx_20_YYyy V[xx] – Radarsat mosaic version number YY – last two digits of mosaic start year yy – last two digits of mosaic end year

¹ See [MEaSURES Greenland Image Mosaics from Sentinel-1A and -1B \(NSIDC-0723\)](#)

² See [MEaSURES Greenland Ice Sheet Mosaics from SAR Data \(NSIDC-0633\)](#)

Satellite	ID Naming Convention
Landsat ³	LXSS_LLLL_PPPRRR_YYYYMMDD_yyyymmdd_CC_TX L = Landsat X = Sensor C = OLI/TIRS combined O = OLI-only T = TIRS-only E = ETM+ T = TM M = MSS SS = Satellite (07 = Landsat 7, 08 = Landsat 8) LLLL = Processing correction level (L1TP, L1GT, or L1GS) PPP = WRS path RRR = WRS row YYYYMMDD = Acquisition year, month, day yyyymmdd = Processing year, month, day CC = Collection number (01, 02, ...) TX = Collection category (RT = Real-Time, T1 = Tier 1, T2 = Tier 2)

1.1.2 Sample Data Record

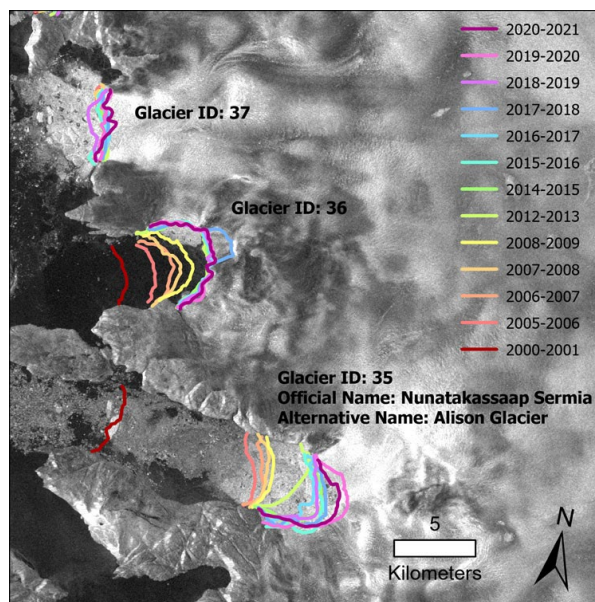


Figure 1. Ice Front Positions, Glaciers 35, 36, and 37

³ Landsat source images retain the USGS naming convention. For more information, see [“What is the naming convention for Landsat Collections Level-1 scenes?”](#)

1.2 File Information

1.2.1 Format

Data are provided as Esri shapefiles. A shapefile is a vector data storage format that contains multiple files. The shapefiles in this data set include the following files:

- .shp – stores the feature geometry
- .shx – stores the index of the feature geometry
- .dbf – dBASE table that stores the attribute information
- .sbn, .sbx – stores the spatial index of the features
- .prj – stores the coordinate system information
- .cpg – specifies the code page for identifying the character set to be used
- .xml – metadata file

1.2.2 File Naming Convention

1.2.2.1 Glacier ID Shapefile

The glacier ID shapefile consists of the following files:

- GlacierIDs_v02.0.cpg
- GlacierIDs_v02.0.dbf
- GlacierIDs_v02.0.prj
- GlacierIDs_v02.0.sbn
- GlacierIDs_v02.0.sbx
- GlacierIDs_v02.0.shp
- GlacierIDs_v02.0.shp.xml
- GlacierIDs_v02.0.shx

1.2.2.2 Termini Shapefiles

Termini shapefiles comprise the same eight file types as the glacier ID shapefile. They use the following naming convention:

Example File Name

termini_1972_1973_v02.0.shp

Naming Convention

termini_[YYYY_yyyy]_[v02.0].[ext], where:

- YYYY_yyyy = winter season
- v02.0 = version 2.0
- ext = file extension (See “Section 1.2.1 | Format”.)

1.3 Spatial Information

1.3.1 Coverage

Data are provided for 239 individual glaciers within the following boundaries:

Southernmost Latitude: 60° N
 Northernmost Latitude: 83° N
 Westernmost Longitude: 75° W
 Easternmost Longitude: 14° W

1.3.2 Resolution

The nominal uncertainty in digitized terminus locations is 50 m, but may be larger if the source imagery exhibits poor contrast at the terminus (e.g., tidewater glaciers with persistent melange). Nominal ground resolution for the source mosaics and imagery ranges between 15 m and 50 m.

1.3.3 Geolocation

The following table provides information about geolocating this data set:

Table 4. Geolocation Details

Geographic coordinate system	WGS 84
Projected coordinate system	WGS 84/NSIDC Sea Ice Polar Stereographic North
Longitude of true origin	-45°
Latitude of true origin	70°
Scale factor at longitude of true origin	1
Datum	World Geodetic System 1984
Ellipsoid/spheroid	WGS 84
Units	meters
False easting	0.00000000
False northing	0.00000000
EPSG code	3413
PROJ4 string	+proj=stere +lat_0=90 +lat_ts=70 +lon_0=-45 +k=1 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs
Reference	http://epsg.io/3413

1.4 Temporal Information

1.4.1 Coverage

Temporal coverage spans the winter seasons 1972–1973 to 2020–2021. Note that the date of the source image that was digitized to produce each glacier’s terminus position can lie anywhere within that winter season’s date range. Users should consult the “SourceDate” attribute (see Table 1) to determine the exact date associated with a glacier’s terminus location.

1.4.2 Resolution

One ice front position is provided per year per glacier⁴.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

Ice front positions have been digitized from a variety of sources, including base maps in the [MEaSURES Greenland Ice Sheet Mosaics from SAR Data](#) (NSIDC-0633) and [MEaSURES Greenland Image Mosaics from Sentinel-1A and -1B, Version 2](#) (NSIDC-0723) data sets, plus imagery from the Landsat 1 through Landsat 5 and Landsat 7 and Landsat 8 missions.

2.2 Derivation Techniques and Algorithms

From 2000 through 2013, most termini were digitized from mosaics of RADARSAT satellite data. For the most recent 7 years (2014–2015 through 2020–2021), terminus positions were traced in mosaics of Copernicus Sentinel-1A and Sentinel-1B images. Sentinel-1 data were used starting with the 2014–2015 winter season. Images acquired by Landsat missions were used to construct terminus positions prior to 2000–2001 (see Black and Joughin, 2022) and to fill gaps in mosaic coverage throughout the data record.

Positions have been digitized for termini with widths roughly ≥ 1.5 km. With few exceptions, all glaciers in each winter season’s source mosaic, that meet the width criteria, have been digitized.

In cases where a terminus was highly fractured, its position does not include areas which were fully detached. This determination is subjective (Bjørk et al., 2015; Joughin et al., 2016; and Black and Joughin, 2022).

⁴ Ice front positions are not available for all years and all glaciers.

2.3 Quality, Errors, and Limitations

Image quality varies and should be considered on a per-glacier basis. Errors in digitized terminus location may occur due to:

- Image distortion caused by local topography
- Difficulty distinguishing intact glacier ice from an adjacent glacier or sea ice
- Highly fractured terminus areas
- Resolution limits
- Manual digitization error

Polylines cover *roughly* the full width of the active glacier terminus; line ends do not necessarily indicate a junction between ice and rock or any other defined measure of a glacier’s edge. As such, this data set should not be used to measure terminus width.

2.4 Instrumentation

2.4.1 Description

For information about the SAR systems used to construct the mosaics from which this data set is derived, see the [Alaska Satellite Facility's SAR Basics](#) web page, the Japan Aerospace Exploration Agency (JAXA) [About ALOS - PALSAR](#) site, and [the European Space Agency's Copernicus Sentinel-1](#) site. Information about Landsat is available on the USGS [Landsat Satellite Missions](#) web site.

3 VERSION HISTORY

Consult the following table for this data set’s version history:

Table 5. Version History

Version	Description
V2.0 (May 2022)	<ul style="list-style-type: none"> • Landsat imagery used to extend temporal coverage to 1972–1973 through 2020–2021 for glaciers with IDs 1–75 and 79–90.
V2.0 (Oct. 2021)	<ul style="list-style-type: none"> • Temporal coverage extended through winter 2020–2021. • Gaps in mosaic coverage throughout the data record filled using Landsat-7 and Landsat-8 imagery. Every winter season now contains terminus locations for every glacier. • Data quality flags added for some pre-2014 terminus positions.
V1.2 (Oct. 2017)	<p>Added glaciers to two winters:</p> <ul style="list-style-type: none"> • 2006/2007 – glaciers 90 and 91 • 2008/2009 – glaciers 1-9, 90, and 91

Version	Description
V1.1 (Aug. 2017)	Minor changes include: <ul style="list-style-type: none"> • Added data for winters of 2014/2015, 2015/16, 2016/17 • Added new parameter attributes for the new data • Added 29 new glaciers • Provided a new GlacierID file with added glaciers and updated attributes
V1 (Sep. 2015)	Initial release

4 RELATED DATA SETS

[Digital SAR Mosaic and Elevation Map of the Greenland Ice Sheet](#)

[RAMP AMM-1 SAR Image Mosaic of Antarctica](#)

[MEaSURES Greenland Ice Sheet Mosaics from SAR Data](#)

[MEaSURES Greenland Ice Sheet Velocity Map from InSAR Data](#)

[MEaSURES Greenland Ice Velocity: Selected Glacier Site Velocity Maps from InSAR](#)

[MEaSURES InSAR-Based Antarctica Ice Velocity Map](#)

[MEaSURES InSAR-Based Ice Velocity Maps of Central Antarctica: 1997 and 2009](#)

[MEaSURES InSAR-Based Ice Velocity of the Amundsen Sea Embayment, Antarctica](#)

5 CONTACTS AND ACKNOWLEDGMENTS

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6 REFERENCES

Bjørk, A. A., L. M. Kruse, and P. B. Michaelsen. 2015. Brief communication: Getting Greenland's glaciers right – a new data set of all official Greenlandic glacier names. *The Cryosphere* 9(6): 2215-2218. doi: <https://doi.org/10.5194/tc-9-2215-2015>.

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7 DOCUMENT INFORMATION

7.1 Publication Date

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7.2 Date Last Updated

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