



Images of Antarctic Ice Shelves, Version 2

USER GUIDE

How to Cite These Data

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

Scambos, T., J.Bohlander, B.Wallin, M. Klinger, M. Fisher, R. Marowitz, and M. Hardman. 2022.
Images of Antarctic Ice Shelves, Version 2. [Indicate subset used]. Boulder, Colorado USA. NASA
National Snow and Ice Data Center Distributed Active Archive Center.
<https://doi.org/10.5067/W87VCY3CW0MJ>. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT <https://nsidc.org/data/NSIDC-0102>



National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Parameters

Images of Antarctic Ice Shelves is a visual time-series record depicting year-round ice extent, iceberg calving events, rift formation, surface structures on the ice, sea ice and fast ice conditions, surface melting, and melt ponding that occur at 27 selected ice shelf areas around the Antarctic continent. Images are derived using data from the visible and thermal bands of the MODIS (2000-present) and AVHRR (1989-2001) sensors. The images are selected by visual inspection for low cloud cover and events of significance. Although coverage frequency varies, selection criteria aim to provide 1 to 5 images for every month of each of the ice shelf areas.

1.2 File Information

1.2.1 Format

MODIS images are provided in GeoTIFF and non-georeferenced PNG and JPEG formats. AVHRR images are provided in non-georeferenced PNG and JPEG formats.

1.2.2 File Contents

Figure 1 contains examples of MODIS images of the Filchner ice shelf in both the thermal (a) and visible (b) channels.

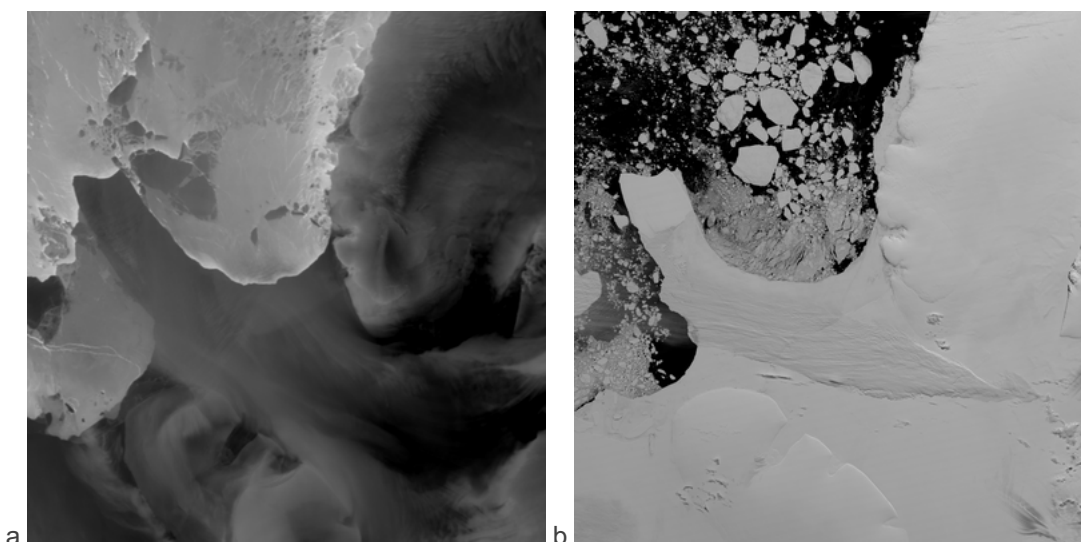


Figure 1. Browse (PNG) versions of MODIS images for the Filchner ice shelf from 01 April 2000 in the thermal channel (a) and from 01 January 2001 in the visible channel (b).

1.2.3 Directory Structure

Image files are available within ice-shelf specific directories at

https://daacdata.apps.nsidc.org/pub/DATASETS/nsidc0102_antarctic_iceshelf_images_v2/.

The directory structure is described in Table 1.

Table 1. Directory structure for NSIDC-0102

0102_grid_overlays/	eps/	Vector (Encapsulated Post Script) files that include a lat/long grid and place name labels as depicted in each area's sample map (described below). The user can overlay this vector frame on any image of the same area to obtain a customized map using their date of choice. ¹	
	maps/	Sample maps in JPG format illustrating each ice shelf area, with lat/long grid lines and names of relevant geographical features.	
abbot/** amery/** bryan/ filchner/** fimbul/** getzeast/** getzwest/** larsenb/** larsenc/** larsend/ lazarev/ mertz/# nansen/ pineisland/** porpoise/# ragnhild/ riiserlarsen/** ronne/** rosseast/** rosswest/** sabrina/# scotia/ shackleton/# southgeorgia/ sulzberger/ syowa/ westice/# wilkins/** wordie/	avhrr/ ²	browse/	PNG browse files (thumbnails)
		images/	JPG image files (non-georeferenced)
	modis/	browse/	PNG browse files (thumbnails)
		images/	GeoTIFF image files and accompanying PNG and/or JPG files. For some dates earlier in the record (early 2000s), only a non-georeferenced JPG may be available.

¹ EPS files are only available for the ice shelf areas marked with # above

² only available within directories marked with *

1.2.4 Naming Convention

Image files are named according to the following convention and as described in Table 2.

`nsidc0102_[ice shelf]_[YYYYMMDD_HHMM]_[sensor]_[channel]_v[#].[ext]`

Table 2. File Naming Convention

Variable	Description
nsidc0102	Product ID
[ice shelf]	name of the ice shelf image frame
[YYYYMMDD_HHMM]	date and time of image acquisition
[sensor]	modis or avhrr
[channel]	vis (visible) or therm (thermal)
v[#]	version of the product
.[ext]	file extension: .tiff, .png or .jpg

Some examples:

`nsidc0102_syowa_20110209_0600_modis_vis_v2.tiff`

`nsidc0102_syowa_20110209_0600_modis_vis_v2.png`

`nsidc0102_larsenb_20010909_2238_avhrr_therm_v2.jpg`

Browse files follow the same convention with the addition of `_br_` in the file name and they generally carry the `.png` extension, as in this example:

`nsidc0102_larsenb_20010909_2238_avhrr_therm_br_v2.png`.

1.3 Spatial Information

1.3.1 Coverage

Images are available for 27 ice shelf areas around the Antarctic continent (roughly south of 60°S), as identified in Figure 2. Additionally, Figure 3 locates the image frames established exclusively to track the northward drift of two large icebergs during 2006-2007.

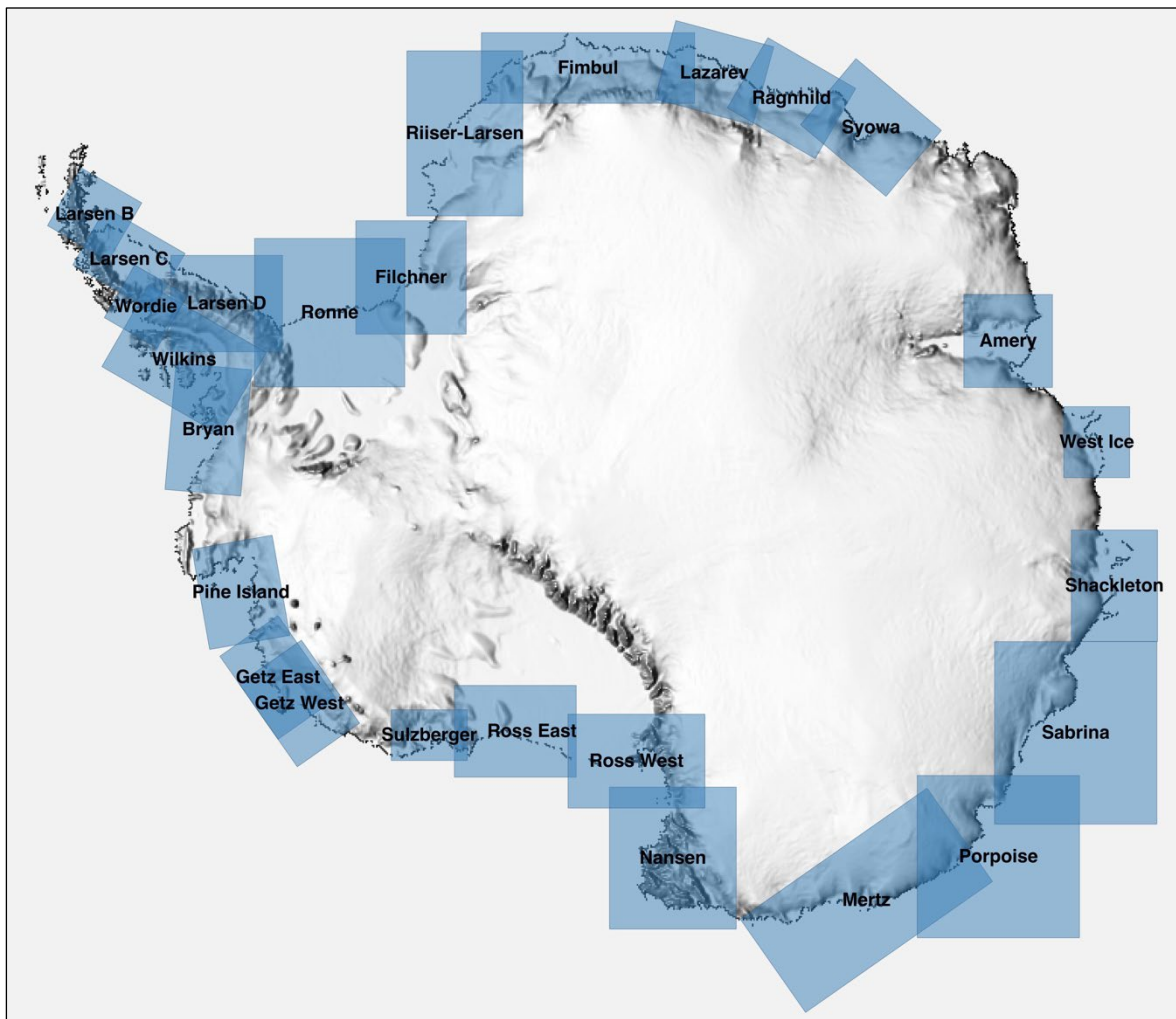


Figure 2. Location of the image frames for each of the ice shelf areas. The background image is the Reference Elevation Model of Antarctica (REMA)

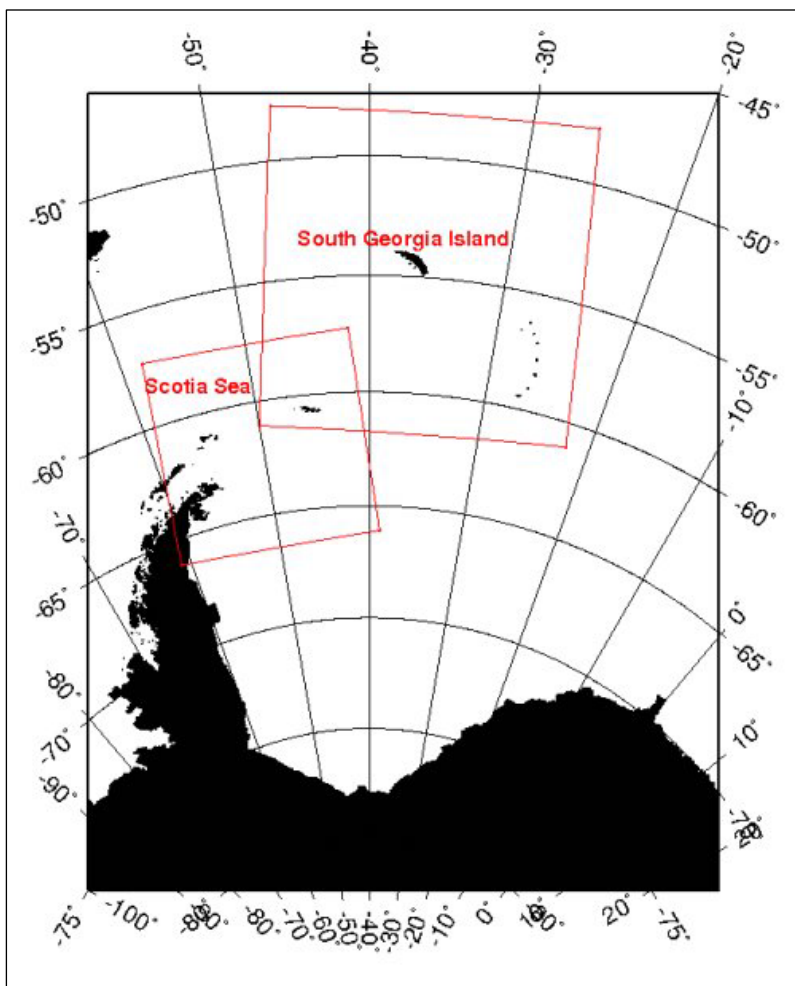


Figure 3. Image frames for an area in the Scotia Sea and another around the South Georgia Island were established to track the northward drift of two large icebergs, A22A and UK211 (a.k.a. *Amigosberg*). This event, which happened during 2006-2007, was documented in Scambos et al. (2007, 2011) and featured by the NASA Earth Observatory. MODIS images for this event are available in the /scotia/ and /southgeorgia/ directories.

1.3.2 Resolution

AVHRR images were processed to a 1 km image resolution, while MODIS images are processed to a 250 m image resolution.

1.3.3 Geolocation

MODIS images are georeferenced to the WGS 84 / Antarctic Polar Stereographic projection ([EPSG:3031](#)), with origin and reference lat/long varying by ice shelf frame. Detailed projection parameters, grid dimensions, and corner coordinates are provided for each ice shelf frame in Appendix A. Exceptionally, the Scotia and South Georgia frames related to the iceberg tracking events are georeferenced to the WGS 84 / Lambert Conformal Conic projection with a central meridian of 36°W and latitude of origin of 55°S.

AVHRR images are not geolocated. Users may use the respective projection parameters and corner coordinates provided in Appendix A to manually geolocate them. They can also be mapped for illustration purposes using the EPS vector files described in Table 1.

1.4 Temporal Information

1.4.1 Coverage

AVHRR images are available from 12 August 1989 to 14 October 2001.

MODIS images are available from 3 March 2000 to present, with new images published on a monthly basis.

1.4.2

1.4.3 Resolution

The temporal resolution varies with the availability of cloud-free images; the goal is to provide 1–5 images per month for each of the ice shelf areas.

2 DATA ACQUISITION AND PROCESSING

2.1 Background

Changes in the extent and stability of Antarctic ice shelves prompted NSIDC to begin a monitoring program of the major ice streams and outlet glaciers along the Antarctic coast. This archive spans back to the late 1980s. Monitoring began using data from the AVHRR Polar 1 km data set and in 2001 switched to MODIS Level 1-B data (with some overlap between the two sensors during 2000 and 2001). Most of the Antarctic coastline is being monitored year-round. This archive is a selected subset of scenes, generally the clearest and most informative scenes available.

2.2 Acquisition

Current production relies on the MODIS Level-1B calibrated radiances products. Specifically, MODIS visible images are produced from Terra (MOD02QKM) and Aqua (MYD02QKM) Band 2 data (250 m), while thermal images are produced from Terra (MOD021KM) and Aqua (MYD021KM) Band 32 data (1 km). Geolocation fields from MOD03/YD03 are used in the georectification step.

The older AVHRR images were derived from Local Area Coverage (LAC) and High-Resolution Picture Transmission (HRPT) data from several of the later NOAA polar orbiter satellites (NOAA-10 to -16).

2.3 Processing

MODIS data are downloaded from LAADS DAAC, georectified and spatially subset into the ice shelf regions, then transformed into PNG images, browse PNG images, and GeoTIFF files. The production workflow is depicted in Figure 4.

There are two production modes: during months October through March (austral summer), only visible images (from band 2) are processed, and during April through September (austral winter), only thermal images (from band 32) are processed.

The derived MODIS thermal images are processed to retain an accurate approximate skin temperature. MODIS thermal data are initially 1 km spatial resolution and 12-bit radiometric resolution. In the derived 8-bit thermal images, bright signatures represent warm areas, most commonly leads and exposed sea ice. Dark signatures represent cold areas such as crevasses (where cold air collects) and high plateaus. An exception occurs with temperature inversions, typical of the Antarctic winter. In these cases, cold air settles in valleys, and increased temperatures are seen on adjacent higher terrain. The thermal images also reveal local wind effects at the surface. To convert MODIS-derived thermal images to approximate surface temperature, NSIDC uses the following equation:

$$T_K = \frac{DN}{5} + 225 ,$$

where DN is the 8-bit pixel value and T_K is the surface temperature in kelvins.

AVHRR thermal images are uncalibrated, and radiometric values are opposite those of MODIS images. In the AVHRR images, dark pixels indicate warm areas and bright pixels indicate cold areas. In MODIS images, dark pixels indicate cold areas and bright pixels indicate warm areas.

A manual QC process is performed on both thermal and visible images to select mostly cloud-free scenes, among other criteria described in the next section. Finally, the thermal images are spatially disaggregated to match the visible images' resolution of 250 meters.

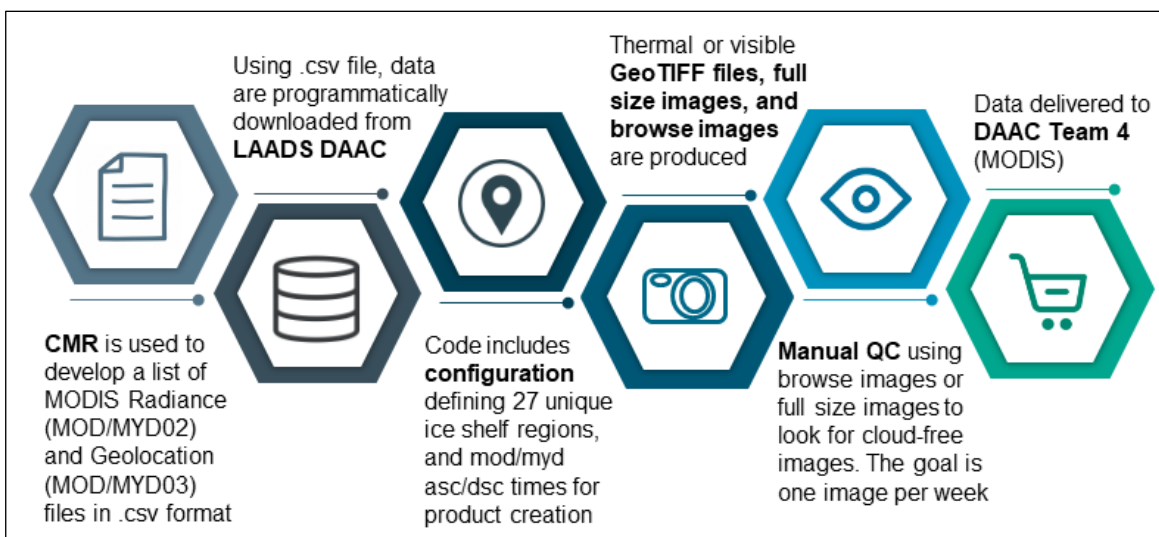


Figure 4. Production workflow of Images of Antarctic Ice Shelves, as defined by the NSIDC Data Production Team.

2.4 Quality Reviews

The manual QC of the images of Antarctic Ice shelves data product is a valuable step in providing clear images to the public (as cloud-free as possible).

Each ice shelf has unique characteristics and features that the production team is trained to identify and prioritize when selecting the best images for the month. Following the visual inspection of the PNG images, the GeoTIFFs are inspected for proper geolocation and frame size for each ice shelf.

2.5 Instrumentation

2.5.1 MODIS

The MODIS instrument provides 12-bit radiometric sensitivity in 36 spectral bands ranging in wavelength from 0.4 μm to 14.4 μm . Bands 1-2 are imaged at a nominal resolution of 250 m at nadir, bands 3-7 at 500 m, and the bands 8-36 at 1000 m. A ± 55 -degree scanning pattern at an altitude of 705 km achieves a 2330 km swath with global coverage every one to two days. The MODIS instrument flies on board the Terra and Aqua satellites, the first launched in December 1999, the second in May 2002. For additional details about the MODIS instruments, see NASA's [MODIS | About](#) Web page.

2.5.2 AVHRR

The Advanced Very High Resolution Radiometer (AVHRR) is a cross-track scanning system with five spectral bands having a resolution of 1.1 km and twice-daily earth scans. This sensor has been

launched on board with several polar-orbiting satellites since the late 1970s. More details about this instrument can be found on the [NOAA CLASS website](#).

3 VERSION HISTORY

Table 3. Version History Summary

Version	Release Date	Description of Changes
V2	9 April 2024	Additional authors were added to the data set citation.
V2	19 April 2022	The data set was transferred to the NSIDC DAAC and forward processing of MODIS data began by the NSIDC Data Production Team.
V1	1996	Initial release

4 ACKNOWLEDGMENTS

MODIS images from September 2020 onwards are produced by the NSIDC DAAC Data Production Team.

5 REFERENCES

Scambos, T., J. Bohlander, T. Haran, R. Ross, and R. Bauer. (2007). Antarctic tabular iceberg evolution during northward drift: A proxy system for studying ice shelf break-up. In: Antarctica: A Keystone in a Changing World – Online Proceedings of the 10th ISAES, edited by A.K. Cooper and C.R. Raymond et al., USGS Open-File Report 2007-1047, Extended Abstract 157, 6 p. (see [PDF](#))

Scambos, T., R. Bauer, J. Bohlander, J. Thom, and Y. Yermolin. (2011). Climate, Drift, and Image Data from Antarctic Icebergs A22A and UK211, 2006-2007. U.S. Antarctic Program (USAP) Data Center. <https://doi.org/10.7265/N5N014GW>

Other References Using these Data:

Scambos, T.A., Hulbe, C., Fahnestock, M. and Bohlander, J. (2000). The link between climate warming and break-up of ice shelves in the Antarctic Peninsula. *Journal of Glaciology*, 46(154), pp.516-530. <https://doi.org/10.3189/172756500781833043>

Alley, K.E., Scambos, T.A., Siegfried, M.R. and Fricker, H.A. (2016). Impacts of warm water on Antarctic ice shelf stability through basal channel formation. *Nature Geoscience*, 9(4), pp.290-293. <https://doi.org/10.1038/ngeo2675>

Haug, T., Kääb, A. and Skvarca, P. (2010). Monitoring ice shelf velocities from repeat MODIS and Landsat data—a method study on the Larsen C ice shelf, Antarctic Peninsula, and 10 other ice shelves around Antarctica. *The Cryosphere*, 4(2), p.161. <https://doi.org/10.5194/tc-4-161-2010>

Luckman, A., Elvidge, A., Jansen, D., Kulesa, B., Munneke, P.K., King, J. and Barrand, N.E. (2014). Surface melt and ponding on Larsen C Ice Shelf and the impact of föhn winds. *Antarctic Science*, 26(6), pp.625-635. <https://doi.org/10.1017/S0954102014000339>

Lazzara, M.A., Jezek, K.C., Scambos, T.A., MacAyeal, D.R. and Van der Veen, C.J. (1999). On the recent calving of icebergs from the Ross Ice Shelf. *Polar Geography*, 23(3), pp.201-212. <https://doi.org/10.1080/10889379909377676>

6 DOCUMENT INFORMATION

6.1 Publication Date

December 2022

6.2 Date Last Updated

April 2024

APPENDIX A: GEOLOCATION PARAMETERS

	Abbot Ice Shelf	Amery Ice Shelf	Bryan Coast
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-70	-71	-71
Map Reference Longitude	-100	90	-85
Map Origin X	176000.00	-960500.00	-176665.75
Map Origin Y	2021000.00	2347500.00	2019298.30
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2500	1832	2500
Grid Height	1300	1748	1500
Corner Coordinates			
UL (lat lon)	-71.430666 -104.977081	-66.958927 67.747650	-71.500000 -90.000001
LL (lat lon)	-74.351449 -105.923715	-70.500059 63.312138	-74.862171 -91.131490
UR (lat lon)	-71.056695 -87.480948	-68.162064 77.911910	-71.128583 -72.488734
LR (lat lon)	-73.905142 -85.181644	-71.960057 75.258651	-74.405465 -69.758791

The map unit is meter. Latitude and longitude coordinates are given in degrees North and East, respectively.

	Filchner Ice Shelf	Fimbul Ice Shelf	East Getz Ice Shelf
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-71	-71
Map Reference Longitude	0	0	-125
Map Origin X	-1086000.00	-467200.00	-166000.00
Map Origin Y	1324000.00	2251200.00	1910500.00
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2176	4205	2000
Grid Height	2236	1392	1400
Corner Coordinates			
UL (lat lon)	-74.333890 -39.360032	-69.065858 -11.724375	-72.482390 -129.965858
LL (lat lon)	-77.816880 -54.829558	-72.102388 -13.790570	-75.627171 -131.071105
UR (lat lon)	-76.887199 -22.271768	-68.829812 14.538165	-72.286861 -115.090851
LR (lat lon)	-81.383575 -35.321080	-71.823658 17.051104	-75.387159 -112.929689

	West Getz Ice Shelf	Larsen B Ice Shelf	Larsen C Ice Shelf
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-70	-70
Map Reference Longitude	-125	-60	-60
Map Origin X	-331500.00	-176500.00	-281500.00
Map Origin Y	1910500.00	2898500.00	2694000.00
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2000	1316	1300
Grid Height	1500	1384	1800
Corner Coordinates			
UL (lat lon)	-72.290332 -134.843657	-63.649303 -63.484642	-65.366780 -65.965272
LL (lat lon)	-75.612959 -137.180720	-66.692422 -63.955200	-69.338173 -67.149367
UR (lat lon)	-72.480626 -119.967177	-63.661344 -56.993178	-65.493212 -59.080241
LR (lat lon)	-75.850357 -118.747861	-66.706242 -56.586833	-69.491798 -58.895963

The map unit is meter. Latitude and longitude coordinates are given in degrees North and East, respectively.

	Larsen D Ice Shelf	Lazarev Ice Shelf	Mertz Glacier
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-71	-71
Map Reference Longitude	0	15	145
Map Origin X	-1997539.4	-123655.25	-572166.93
Map Origin Y	1153279.9	2359484.50	2760638.43
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2200	2000	4500
Grid Height	1900	1600	2250
Corner Coordinates			
UL (lat lon)	-69.000000 -60.000000	-68.500000 12.000002	-64.466132 133.290723
LL (lat lon)	-70.759198 -71.238256	-72.069277 11.389540	-69.311396 130.411481
UR (lat lon)	-73.083165 -51.459878	-68.263926 24.056587	-64.500422 156.319020
LR (lat lon)	-75.361162 -64.889104	-71.782959 25.863611	-69.354683 159.109464

	Nansen Ice Shelf	Pine Island Glacier	Porpoise Bay
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-70	-71
Map Reference Longitude	180	-100	0
Map Origin X	-788890.0	-462000.00	1681000.00
Map Origin Y	2167457.5	1910500.00	-1410500.00
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2500	2000	3200
Grid Height	2800	1600	3200
Corner Coordinates			
UL (lat lon)	-68.999998 160.000000	-71.998860 -113.594373	-70.001087 129.999470
LL (lat lon)	-74.751076 151.742055	-75.491196 -117.004071	-64.838684 142.745289
UR (lat lon)	-70.186209 175.669298	-72.492200 -98.868027	-64.164618 119.621610
LR (lat lon)	-76.468218 173.618883	-76.115095 -98.568614	-60.091157 131.699773

The map unit is meter. Latitude and longitude coordinates are given in degrees North and East, respectively.

	Ragnhild Coast	Riiser-Larsen Ice Shelf	Ronne Ice Shelf
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-71	-71
Map Reference Longitude	30	0	0
Map Origin X	-294799.00	-834400.00	-1585000.00
Map Origin Y	2400944.25	2161600.00	1237000.00
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2000	2285	2960
Grid Height	1600	3254	2928
Corner Coordinates			
UL (lat lon)	-67.999999 22.999997	-68.906516 -21.107105	-71.647590 -52.030040
LL (lat lon)	-71.537880 21.619942	-75.481311 -31.750482	-74.775559 -72.319294
UR (lat lon)	-68.082598 34.879092	-70.151112 -6.947479	-76.274403 -34.345045
LR (lat lon)	-71.637792 35.847522	-77.404595 -11.053520	-80.954805 -59.131038

	East Ross Ice Shelf	West Ross Ice Shelf	Sabrina Coast
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-71	-71
Map Reference Longitude	180	180	0
Map Origin X	0.00	-634500.00	2062250.00
Map Origin Y	1418400.00	1570750.00	-750500.00
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2403	2700	3200
Grid Height	1808	1850	3600
Corner Coordinates			
UL (lat lon)	-76.999343 180.000000	-74.499841 158.003895	-69.999348 109.997605
LL (lat lon)	-81.120380 180.000000	-78.283990 150.213388	-66.032441 128.667431
UR (lat lon)	-75.892624 -157.053933	-75.611646 -178.532134	-63.245852 104.693788
LR (lat lon)	-79.554224 -148.150722	-79.816828 -177.920485	-60.253637 119.968062

The map unit is meter. Latitude and longitude coordinates are given in degrees North and East, respectively.

	Shackleton Ice Shelf	Sulzberger Ice Shelf	Syowa Station
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-71	-71
Map Reference Longitude	90	0	40
Map Origin X	200500.00	-911685.0	-308543.75
Map Origin Y	2865500.00	-1086502.5	2512886.50
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	2200	1500	2200
Grid Height	1700	1000	1700
Corner Coordinates			
UL (lat lon)	-63.999957 94.002482	-76.999988 -139.999964	-67.000000 32.999998
LL (lat lon)	-67.733708 94.696125	-75.191503 -145.695455	-70.748700 31.594775
UR (lat lon)	-63.216853 104.671938	-78.879394 -153.702034	-67.064815 45.482893
LR (lat lon)	-66.808002 107.086644	-76.802176 -158.108677	-70.827409 46.589186

	West Ice Shelf	Wilkins Ice Shelf	Wordie Ice Shelf
Map Reference Latitude	-90	-90	-90
Map Second Reference Latitude	-71	-70	-71
Map Reference Longitude	90	-60	-60
Map Origin X	-407750.00	-643000.00	-429835.00
Map Origin Y	2728250.00	2320500.00	-2437712.50
Grid Map Origin Column	0.0	0.0	0.0
Grid Map Origin Row	0.0	0.0	0.0
Grid Map Units per Cell	250	250	250
Grid Width	1400	1856	1200
Grid Height	1300	2664	1200
Corner Coordinates			
UL (lat lon)	-64.999562 81.499788	-68.033833 -75.487811	-67.500009 -70.000012
LL (lat lon)	-67.832484 80.371534	-73.717856 -81.235048	-70.122911 -71.367707
UR (lat lon)	-65.260581 88.782130	-68.752065 -64.417114	-67.802845 -63.054609
LR (lat lon)	-68.131251 88.617637	-74.722679 -66.182431	-70.470203 -63.481887