United States Antarctic Program
Annual Report to SCAGI

Cole Kelleher
Polar Geospatial Center

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UPDATE 1: PGC WEBSITE
The Polar Geospatial Center (PGC) at the University of Minnesota provides geospatial support, mapping, and GIS/remote sensing solutions to researchers and logistics groups in the polar science community.

We support U.S. polar scientists to complete their research goals in a safe, timely, and efficient manner by providing a service which most groups do not have the resources or expertise to complete.

Our mission is to introduce new, state-of-the-art techniques from the geospatial field to effectively solve problems in the least mapped places on Earth.
Launched in 2017

Revised and Updated Guides:
User Services
Commercial Imagery
Stereo Elevation Models
Arctic DEM
Web Mapping Applications
Miscellaneous

Data and Services

Reorganized Data Structure:
Maps
Satellite
Aerial
Elevation
ArcticDEM
REMA
Web Applications
UPDATE 2: NEW PGC DATA PRODUCTS
REMA Strips

Generated from individual DigitalGlobe stereoscopic imagery pairs
Most strips are approximately 17km x 110km
Delivered as 32-bit GeoTiffs referenced to the WGS84 ellipsoid
No ground control or altimetry registration has been applied
2m and 8m resolution coverage (see coverage map)
Temporal strip density varies (see density map)
REMA Strip Statistics

2m Strips: 66,401

2m Area: 47,860,644 sqkm

8m Strips: 121,184

8m Area: 74,706,644 sqkm

Total Uncompressed File Size: 45 Terabytes
REMA Mosaic Tiles

100km x 100km mosaic tiles generated from individual REMA strips
Input strips classified based on the best visual quality
Delivered as 32-bit GeoTiffs referenced to the WGS84 ellipsoid
All tiles are 8m horizontal resolution
Input strips registered to altimetry point clouds obtained from
Cryosat-2 radar and ICESat GLAS laser campaign.
REMA Strip Statistics

Tiles: 1,524

Area: 15,240,000 sqkm

Total Uncompressed File Size: 1.1 Terabytes

100m, 200m, and 1km reduced resolution versions available.
Shaded Relief: Mulock glacier, between Byrd Glacier and the McMurdo Dry Valleys. Flow is from the polar plateau on the right to the Ross Ice Shelf on the left.
Shaded Relief: Larsen C Ice Shelf.
The large crack in the upper right is the beginning of the formation of Iceberg A-68.
North is to the left.
Shaded Relief: Volcanoes in the Flood Range, Marie Byrd Land
Limitations

Data collection capacity of optical satellites

Temporal variability

Software and algorithm development

Compute and storage requirements

Result

REMA is a work in progress and is not a complete data set

As additional data is collected PGC is working to fill problem areas

Expect additional releases in the future

All REMA data is license free and publicly available
REFERENCE DATA MODEL OF ANTARCTICA (REMA)
Release 1.1

ESRI REMA Viewer
REFERENCE DATA MODEL OF ANTARCTICA (REMA)
Release 1.1

NGA REMA Web Application

Reference Elevation Model of Antarctica - DEM File Index and Download

This web application allows a user to select index tiles (resolutions of 2-meter or 6-meter strips or and 8-meter terrain mosaics) of Antarctica Digital Elevation Models (DEM) created by the Polar Geospatial Center. This reveals information about the DEM tile and a download web URL. For selecting multiple indices, use the "Select" tool to draw an area and return information on intersecting DEM tile indices. You can export these results for your reference which also include the download web URLs.

The tools in the subsequent sections below are web applications to view, interact, and download Antarctic DEM data.

POC Acknowledgement Policy
Bulk Download from PGC

Bulk Download

Use the links below to browse the directory for the entire REMA dataset. Refer to the User Documentation to see the directory structure, naming schemes, and download contents.

HTTP: http://data.pgc.umn.edu/elevidem/setsm/REMA

Users familiar with the GNU Wget utility can use the following commands to batch download REMA data:

```
Please note, the first two commands will download the entire archive, which is over 43 TB for geocells and 1 TB for mosaics. Use the subdirectory examples to limit your download.

2-METER STRIPS (ENTIRE DATASET)
```

```
wget -r -N -mh -np -R index.html* --cut-dirs=3 http://data.pgc.umn.edu/elevidem/setsm/REMA/geocell/v1.0/2m/
```

```
8-METER MOSAIC TILES (ENTIRE DATASET)
```

```
wget -r -N -mh -np -R index.html* --cut-dirs=3 http://data.pgc.umn.edu/elevidem/setsm/REMA/mosaic/v1.0/8m/
```

```
2-METER STRIPS (SUBDIRECTORY EXAMPLE)
```

```
wget -r -N -mh -np -R index.html* --cut-dirs=3 http://data.pgc.umn.edu/elevidem/setsm/REMA/geocell/v1.0/2m/567e155/
```

```
8-METER STRIPS (SUBDIRECTORY EXAMPLE)
```

```
wget -r -N -mh -np -R index.html* --cut-dirs=3 http://data.pgc.umn.edu/elevidem/setsm/REMA/geocell/v1.0/8m/sb2w17b/
```

```
8-METER MOSAIC TILES (SUBDIRECTORY EXAMPLE)
```

```
wget -r -N -mh -np -R index.html* --cut-dirs=3 http://data.pgc.umn.edu/elevidem/setsm/REMA/mosaic/v1.0/8m/15_36/
```

Windows Users may have to add "wget" to PATH in Environment Variables.
UPDATE 3: ONGOING PGC DATA IMPROVEMENT AND PRESERVATION INITIATIVES
MAP ARCHIVE

In collaboration with the U.S. Geological Survey and UMN’s Borchert Map Library the PGC is actively

- COLLECTING
- SCANNING
- GEOREFERENCING
- CATALOGING
- DISTRIBUTING

historical and contemporary polar maps from many authors/organizations
USGS (and others) **organize** and **ship** maps to UMN Borchert Map Library.

Borchert **scans** (~25 microns) and **delivers** digital maps to PGC.

PGC staff & students **archive, georeference,** and **catalog**.

**Public maps** available as no-cost digital download from PGC website as TIF, JPEG, PDF, and/or GeoTIFF.

**Private maps** (non-distributable archive, many international authors, maps with commercial imagery) available to researchers on request.
Map Authors:

United States
American Geographical Society
Department of Defense
National Geospatial-Intelligence Agency
National Geographic
NAVOCEANO
Polar Geospatial Center
Toolik LTER
U.S. Geological Survey
University of Texas

International
Asiaq (Greenland)
Australian Antarctic Division (AAD)
Bulgaria (APCB)
British Antarctic Survey (BAS)
GNS Science (New Zealand)
Land Information New Zealand (LINZ)
France (SHOM)
USSR Ministries (Marine, Aviation)
SAGA Maps (Greenland)
Scott Polar Research Institute
UK Hydrologic Office & Ordnance Survey

*additional organizations have not yet been added to public archive*
Status & Timeline (June 2019)

1. PGC Website currently offers over 650 unique Antarctic maps (self-service, multiple formats)

2. All current digital scans received and currently georeferenced, cataloged, and available via PGC website

3. Current and future coordination with the Australian Antarctic Division to integrate maps into the SCAR map catalog.

Most maps in the public domain (especially U.S.), but some are private

Complete metadata is associated with all maps (organization, year, author, etc.)
U.S. ANTARCTIC PLACE NAMES

Coordinate Improvement Status (June 2019):

Point Features
Total: 18,641
63.8% updated

Polygon Features
Total: 9,127 *
55.3% digitized

* eventually, there will be a polygon for all features
U.S. ANTARCTIC PLACE NAMES

**Delivery**

1. Point features sent to US-ACAN for approval (confidence rank 1-5), approved via PGC-developed mapping application; regular updates to USGS GNIS

2. Approved names regularly sent to Google Earth & Maps

3. Corrected and approved names integrated into SCAR CGA via USGS

4. Web mapping application for US-ACAN to easily approve, flag and comment
Using high resolution commercial satellite imagery, PGC has the capability to digitize the Antarctic coastline

Priority Areas: Antarctic Peninsula + Islands, Ross Sea

First pass for major flaws in current ADD coastline at 1:24,000

Detailed (re)digitization at 1:3,000

Submitted back to ADD (via curators at British Antarctic Survey)

Progress currently paused for assessment of automated methods
SCAGI 1:1,000,000 AIR OPERATIONS MAPS

PGC authored 6 of the 1:1,000,000 Air Operations Maps (#11 - #16)

Well received by United States Antarctic Program Air Operations

Future updates with newly available elevation data being discussed