Polar Geospatial Center

Imagery and Geospatial Data Resources for Planning, Awareness, and Safety in Antarctic Waters

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TODAY’S TOPICS

Overview of PGC
Background, Mission, Activities, and Support

Polar Remote Sensing
Commercial, Government, and Open Source

Ice Monitoring Sensors and Products
Optical, Radar, and Microwave – Strengths & Limitations

Polar View (www.polarview.aq)
Data Repository and Derived Products

Wrap Up
Summary, Questions, or Comments
Overview - Polar Geospatial Background

Founded as AGIC in 2007 to support the United States Antarctic Program and Antarctic science

In 2011 AGIC transitioned to PGC as an NSF Cooperative Agreement to provide support both Arctic and Antarctic science and logistics
Overview - Mission

To provide geospatial support, mapping, and GIS/remote sensing solutions to researchers and logistics groups in the polar science community and introduce new, state-of-the-art techniques from the geospatial field to effectively solve problems in the polar regions.
How we use satellite imagery

- Base layer for mapping & cartography
- Polar Orthomosaics
- Antarctic place names management
- Feature extraction (e.g. coastlines)
- Stereo-derived high-resolution digital elevation models (DEM}s)
EXAMPLE SUPPORT REQUESTS – MAPPING & CARTOGRAPHY

USAP Planned Helicopter Landing Site Maps (annual)
STEREO- DERIVED ELEVATION MODELS

Shaded Relief: Kangerlussuaq Airport, Greenland
Jakobshaven Isbrae, Greenland
Shaded Relief: Thermokarst collapse, Kuparuk watershed, Alaska
Shaded Relief: Seymour Island, Antarctica
ANTARCTIC PLACE NAMES

PGC, in accordance with the Advisory Committee on Antarctic Names (ACAN), is curating the Antarctic place names database

- United States only from SCAR Composite Gazetteer of Antarctica (CGA)
- Collaboration with international groups
- Improved geographic placement of point features
- Polygon digitization
Polar Remote Sensing – Commercial Options

The DigitalGlobe Satellite Constellation

DigitalGlobe

National Geospatial-Intelligence Agency

PGC
Commercial Satellites and Imagery

- Commercially owned (DigitalGlobe)
- Licensed to NGA via NextView Contract
- Four satellite vehicles in near-polar orbit
- 30cm to 50cm spatial resolution (panchromatic)
- Optical sensors
- Panchromatic & Multispectral Bands
## Commercial Imagery – Characteristics

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Drawbacks</th>
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<tr>
<td>• Very high resolution (30cm to 50cm GSD)</td>
<td>• Comparatively small geographic footprint</td>
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<tr>
<td>• High positional accuracy (&lt;5m)</td>
<td>• Weather Dependent (optical)</td>
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<td>• Mono &amp; Stereo Collections</td>
<td>• Enormous file sizes</td>
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<tr>
<td>• Panchromatic and multispectral bands</td>
<td>• Generally require some post-processing</td>
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<td>• Some degree of tasking flexibility</td>
<td>• Days/Weeks needed to receive &amp; deliver in large volumes</td>
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<td></td>
<td>• Currently licensed only to U.S. Federally funded researchers</td>
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<td>• Poor choice for regional applications requiring time-sensitive data</td>
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Better Options for Sea Ice Applications

- Government satellite assets
  - JAXA (Japanese Space Agency)
    - AMSR-2 (Passive Microwave Sensor)
  - NASA
    - MODIS Sensor (Passive Optical Sensor)
  - ESA (European Space Agency)
    - Sentinel-1A (Active Radar Sensor)
AMSR-2 (Advanced Microwave Scanning Radiometer)

- Microwave radiometer sensor on JAXA’s GCOM satellite
- Launched May-2012
  - Follow-on to AMSR-E
- Five-year design life
- Observation of precipitation, water vapor, sea water temperature, water levels, and snow depths
AMSR-2 – Relevant Data

Sea Ice Concentration
- Current and Historical (2002)
- Time series animations
MODIS – Moderate Resolution Imaging Spectrometer

- Two sensors on-board NASA’s Terra and Aqua satellites
- Multispectral Imaging Instrument
- True-color composites
- 250m Resolution
  - 1km
  - 5km
**Sentinel-1A**

- Synthetic Aperture Radar
- Launched April of 2014

**Purpose:**
- Sea Ice
- Land Use
- Oil Spills
- Emergency Response
SAR Imagery (Synthetic Aperture Radar)

Active Sensor

Day & Night Collection

Weather Independent

Polar Orbiting

Sensors: Sentinel-1A, TerraSAR, RadarSAT, etc.
Sentinel-1A Radar Imagery

40m Pixel Resolution – B&W
400km x 400km scene footprint size
Multiple formats & file sizes available
Polar View

Web interface for obtaining and visualizing Polar remote sensing products and derived analytics

- Forecasts
- Types
- Concentration
- Thickness
- Pressure
- Drift

Georeferenced raster images

Sea Ice Animations

GIS-ready ice-edge polyline files
Polar View (www.polarview.aq)
Polar View AMSR-2 Derived Ice Edge & Concentration

Ice-edge polyline files
- ESRI Shapefiles
- Google Earth KMZ

Sea Ice Concentration
- GeoTIFFs
- Google Earth KML
Polar View – MODIS Image Composite (Previous Day)

Mosaic of previous day’s MODIS imagery over Antarctica

JPEG download (although not georeferenced)
Polar View – Iceberg Data (NOAA National Ice Center)

CSV Downloads
NASA Worldview
(https://worldview.earthdata.nasa.gov)
Helpful links and resources

1. PGC website: www.pgc.umn.edu
   a) Antarctic maps: http://pgc.umn.edu/maps/antarctic
   b) Viewer access: https://users.pgc.umn.edu/request/
   c) Coordinate converter: http://www.pgc.umn.edu/tools/conversion
   d) Stereo DEMs: http://www.pgc.umn.edu/elevation/stereo


3. NASA Worldview: https://worldview.earthdata.nasa.gov

4. DigitalGlobe browse: https://browse.digitalglobe.com

5. RISCO (Rapid Ice Sheet Change Observatory): http://www.rapidice.org/viewer/