Guide: FRIDGE User Guide
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Overview

PGC's Federal Research Imagery and DEM Geospatial Explorer (**FRIDGE)** is a web application that provides quick access to PGC's elevation and satellite imagery products of the polar regions. Users can view, download, and order high-resolution open and/or licensed data. Access to licensed data requires a PGC user account and is limited to federally-funded researches, subcontractors, or federal employees working under an active NSF-OPP award.

This guide outlines FRIDGE's core features and how to use them effectively.

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Background

The Polar Geospatial Center maintains a multi petabyte-scale repository of digital elevation models (DEMs) and commercial satellite imagery covering the Earth's polar regions. Querying and accessing data from such a large archive presents many opportunities. PGC's **FRIDGE** was developed to provide the U.S. federally-funded polar science and logistics community streamlined and dynamic access with standardized data product options. FRIDGE also provides open access to DEMs produced through the ArcticDEM and Reference Elevation Model of Antarctica (REMA) projects.

FRIDGE has two primary interfaces:

1. ***Open Data Access*** which facilitates open access to the ArcticDEM and REMA elevation data products with no authentication required.
2. ***Licensed Data Access*** which facilitates secure access for U.S. federally-funded (NSF-OPP) researchers and logistics personnel to Vantor (formerly Maxar) commercial satellite imagery and DEMs covering polar regions in accordance with the Electro-Optical Commercial Layer (EOCL) license. Authentication and user permissions are managed by PGC User Accounts, allowing access to many other PGC applications.

Account Registration

Open Data Access digital elevation models released under the ArcticDEM and REMA projects do not require a PGC account login.

Licensed Data Access requires a PGC user account login and is limited to polar federally-funded researchers with current awards, federal employees, or subcontractors. Primary funding comes from, but is not limited to, the National Science Foundation (NSF) Office of Polar Programs. Members of the DoD/IC and Antarctic/Arctic support personnel may also request access. Licensed DEMs include Alaska data from June 2022-present.

The link below is for new users to request a new account. The PGC will verify your funding source after you submit a request for an account.

Request a New Account

License & Usage

By using PGC products and services, including accessing data via FRIDGE, users agree to:

- Acknowledge PGC and its sponsorship by the National Science Foundation (NSF) in all publications, web pages, and media interviews.
- Properly attribute the original source of any third-party data supplied by PGC.

Acknowledging PGC's support is essential for providing feedback and measuring its impact within the scientific community.

PGC Acknowledgement Policy

For data specific guidelines:

Open Data Access

When using open data or resources from the FRIDGE application, proper acknowledgment and citation are required to give credit to the authors and providers, maintain academic integrity, and support reproducibility of research. Visit the links below for guidance:

- DEM Usage Guidelines
- PGC DEM Products Guide

Licensed Data Access

When using licensed data or resources from the FRIDGE application, proper acknowledgment, citation, and publication approval are required to comply with the licensing agreement, give credit to the authors and providers,

maintain academic integrity, and support PGC. Visit the links below for guidance:

- Electro-Optical Commercial Layer (EOCL) License FAQ
- Citation & Publication Approval Guide
- PGC Commercial Imagery Usage Guidelines

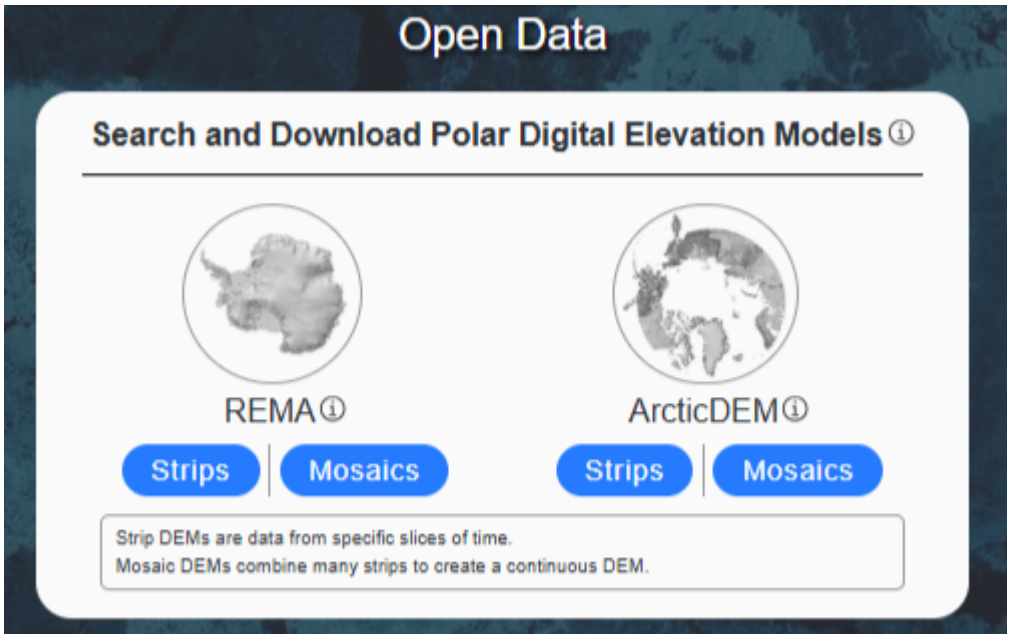
Open Data Access

Polar Digital Elevation Models

FRIDGE Open Data Access currently consists of polar digital elevation models (DEMs) produced under the ArcticDEM and REMA projects. Available in two product types: strips and mosaics. All DEMs may be previewed (as hillshades) within FRIDGE and downloaded directly from the interface.

Please note that all elevation values are relative to the WGS84 ellipsoid, not natively referenced to the geoid, orthometric heights, or to Mean Sea Level. If you would like to convert these files to an approximation of mean sea level, follow our tutorial here.

1. Strips vs. Mosaics



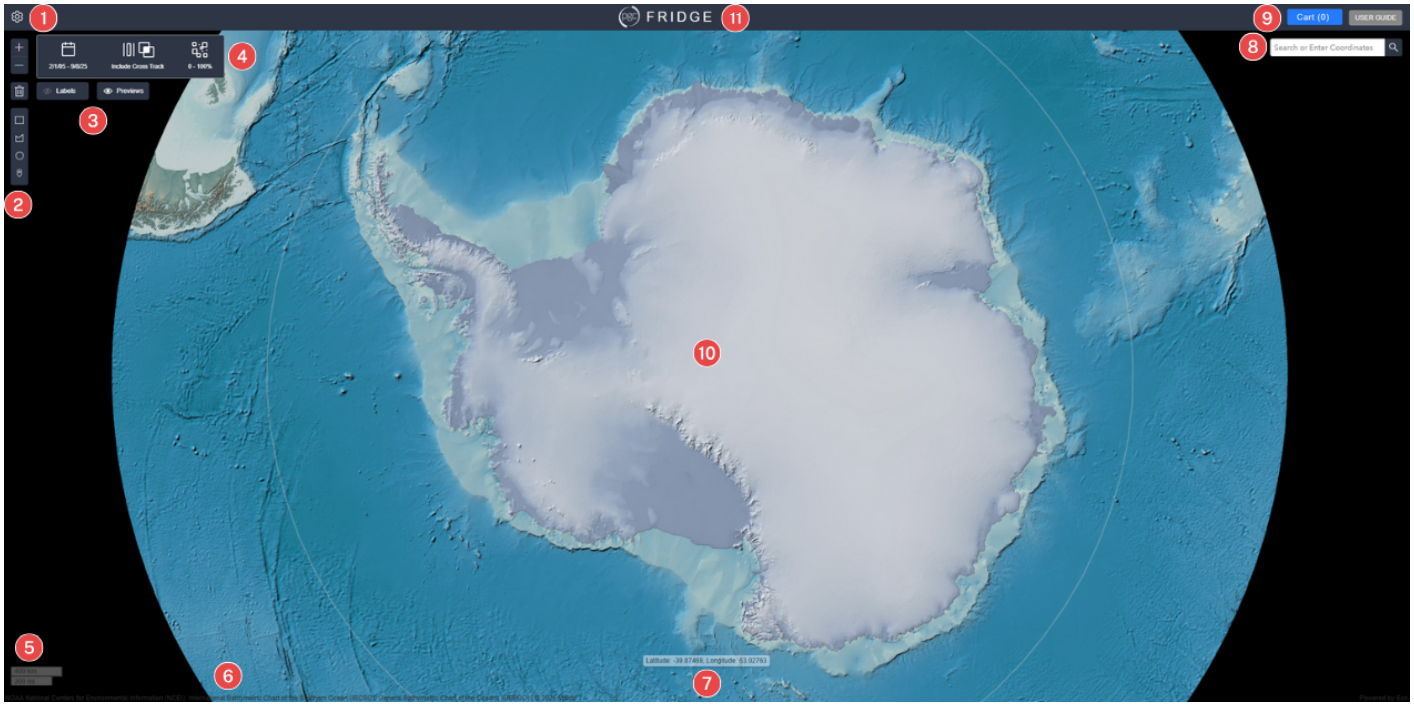
PGC elevation strips are narrow slices of elevation data corresponding to the overlapping area, specific time, and dates of the input pair of stereoscopic images from which they were derived. DEM strips are valuable for temporal and time-sensitive analyses due to their specific timestamps but do not undergo visual inspection prior to release. DEM strips can be queried temporally and/or geographically.

PGC elevation mosaics combine many of the strips into one seamless tile, giving a complete view of the terrain. DEM mosaics are valuable for their comprehensive coverage and visualizations. Mosaic tile DEMs can only be queried geographically.

Think of strips as individual pieces, and mosaics as the full picture.

2. User Interface Overview

Upon launching a chosen regional product of the Polar Digital Elevation Models (REMA/ArcticDEM and Strips/Mosaics), users encounter a map-based interface with several essential components (shown below is the interface for REMA Strips):



Main Screen Layout

#	*Item*	*Description*
1	Settings	Account logout, options to change award and collection selection, and access feedback form.
2	Navigation Panel	Interact with the map window with zoom, trash/clear, and selection tools. Define an Area of Interest (AOI) by drawing a rectangle, polygon, radius, or location point using the map viewport. Delete AOI to restart. Save AOI for future use cases.
3	Map Display Options	View placename labels and DEM data scene previews.
4	Query Panel (strips only)	Query tools to manage various metadata parameters: time, collection method (in-track, cross-track), and percent valid data. See *note* below and PGC DEM guide for more information.
5	Scale Bar	Align the measurement with the bar to estimate the real-world distance (kilometers or miles).
6	Data Sources	Data providers of foundational basemap and geospatial layers.
7	Coordinates	View the map coordinates in decimal degrees (DD) at your cursor location. Use the PGC coordinate converter app to update your inputs to the correct DD format.
8	Search Location	Find specific locations or features by placenames or decimal degree (DD) coordinates.
9	Map Geometry Cart and User Guide	Add selected scenes to the cart to export geometry files in shapefile or GEOJson formats that can be used in a geographic information system. Link to FRIDGE User Guide documentation.

#	Item	Description
10	Map Window	View DEMs of the selected polar region in the central display.
11	Landing Page	Visit FRIDGE landing page.

The query panel allows users to apply metadata parameters to better narrow selections.

- **Date selection:** Choose between **Set Time Range** or **Specify Months/Years** to constrict your search based on temporal needs.
- **Cross-Track Filter:** Check the box to exclude cross-track DEMs. This tool allows users to restrict or expand their DEM search based on the stereoscopic imagery collection mode. A stereoscopic pair can be acquired in **cross-track** stereo mode when the satellite completes at least one orbit between the two image collections. However, **in-track** stereo is more accurate because less will have changed in the target location between the two shots.
- **Percent Valid Data:** Filter the strip DEM dataset based on the data quality using the slide bar of percent valid data. In the context of strip DEM metadata fields, “valid” means pixels that are not identified as potentially erroneous data in the strip bitmask raster.

> Find more information about percent valid data in the PGC DEM Products Guide: Metadata

3. Downloading Data

FRIDGE is one of many ways to access PGC’s publicly available ArcticDEM and REMA elevation products (see DEM guide link below). Elevation data via FRIDGE is accessed or downloaded one file at a time rather than in large batches, commonly used when users need specific, targeted datasets. If you require larger datasets, please see our PGC DEM guide for bulk download options (see link below), reach out to your PGC Point of Contact or email pgc-support@umn.edu.

> Find more information about other access points, including bulk download in the PGC DEM Products Guide: Search, Discovery and Download

3.1 STAC Item

All publicly-available DEM data from PGC are also hosted in an open AWS bucket and indexed with a STAC catalog. DEM data assets can be identified using the DEM STAC items and downloaded or used directly in the cloud. Several different products of the selected dataset are available for direct download including hillshades, masked datasets, metadata, and more.

3.2 DIRECT Download

Direct download links simplify the process of acquiring datasets with a one-click option for users to download individual elevation files. All direct downloaded files are packaged as a tarball (.tar.gz) file, a collection of files wrapped up in one single file for easy storage. In a Windows system, use a file archiver application, such as 7-zip, to extract TAR.GZ files. Alternatively, downloaded files can be extracted through command line.

> Find more information about the file structures in the PGC DEM Products Guide: Metadata

Please note that all elevation values are relative to the WGS84 ellipsoid, not natively referenced to the geoid, orthometric heights, or to Mean Sea Level. If you would like to convert these files to an approximation of mean sea level, follow our tutorial here.

Licensed Data Access

Vantor Commercial Satellite Imagery and Alaska ArcticDEMs

PGC provides **secured, licensed** access to Vantor (formerly Maxar) high-resolution commercial satellite imagery of the polar regions and to **Alaska ArcticDEMs acquired after June 2022** through FRIDGE. Access is restricted under the **EOCL license** (an agreement between NRO and Vantor) and requires a registered PGC User Account with verified NSF Office of Polar Programs (OPP) award information.

Polar Imagery Archive

The imagery archive contains native-resolution scenes from **6 sensors** (IKONOS, Quickbird, GeoEye-1, WorldView-1, WorldView-2, WorldView-3) spanning from the **early 2000s to the present**, with new acquisitions added regularly.

Within FRIDGE, users can:

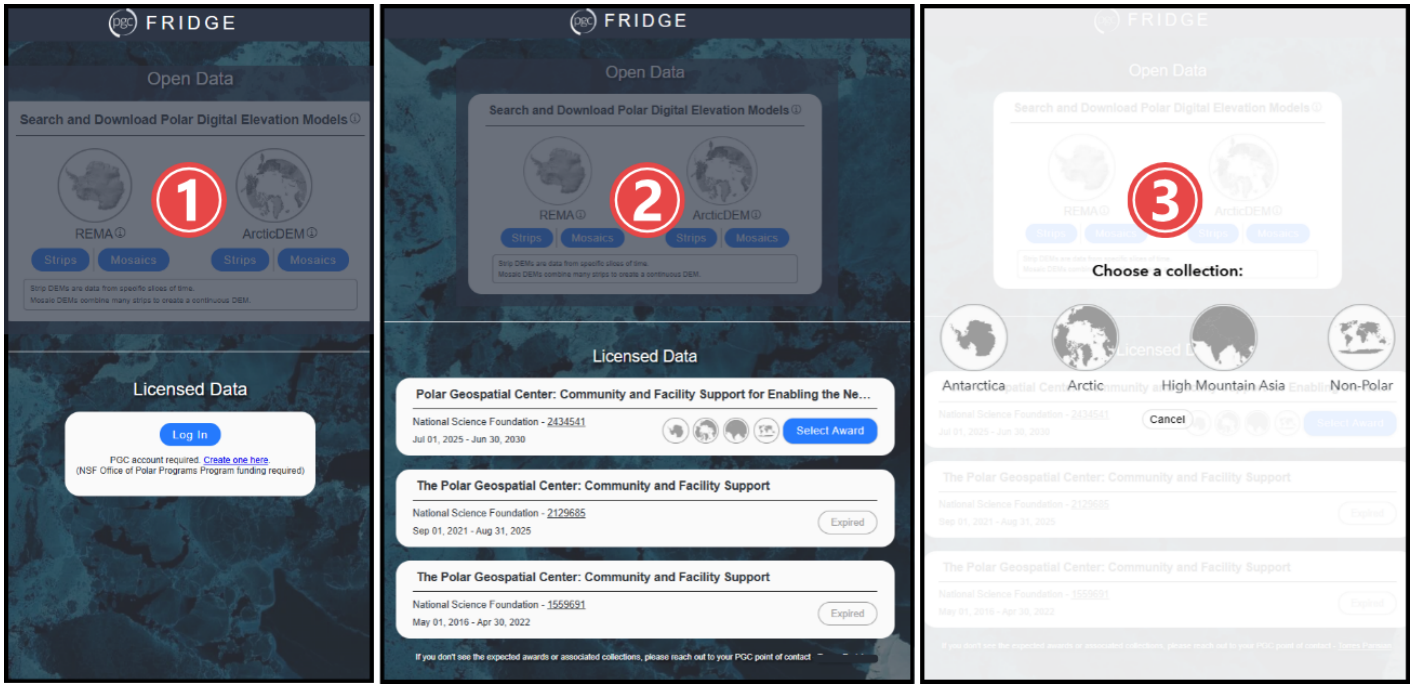
- Search imagery by **location, acquisition date, sensor type, cloud cover, band combinations, illumination,** and **look angle**
- Preview all available imagery directly
- Order raw or processed products delivered to private FTP folders with email notification upon completion

Alaska ArcticDEM Archive

The restricted Alaska ArcticDEM archive contains **DEM strips dated June 2022-present** and are not openly available due to the EOCL contract. Licensed DEMs have the same specs as the ArcticDEM products, 2-meter resolution derived from Vantor (formerly Maxar) imagery provided in 32-bit GeoTIFF format. Elevation units are meters and are referenced to the WGS84 ellipsoid. No ground control or altimetry registration have been applied to the strips. Visit ArcticDEM webpage for more information. Users with funded projects focused in Alaska can dynamically query, toggle, and order imagery and post-June 2022 strip DEMs within the Licensed Data > Arctic Collection interface.

> **All openly available polar DEMs – including pre-June 2022 Alaska ArcticDEMs, ArcticDEM, and REMA – are available within FRIDGE's Open Data access interface.**

1. Award & Collection Selections

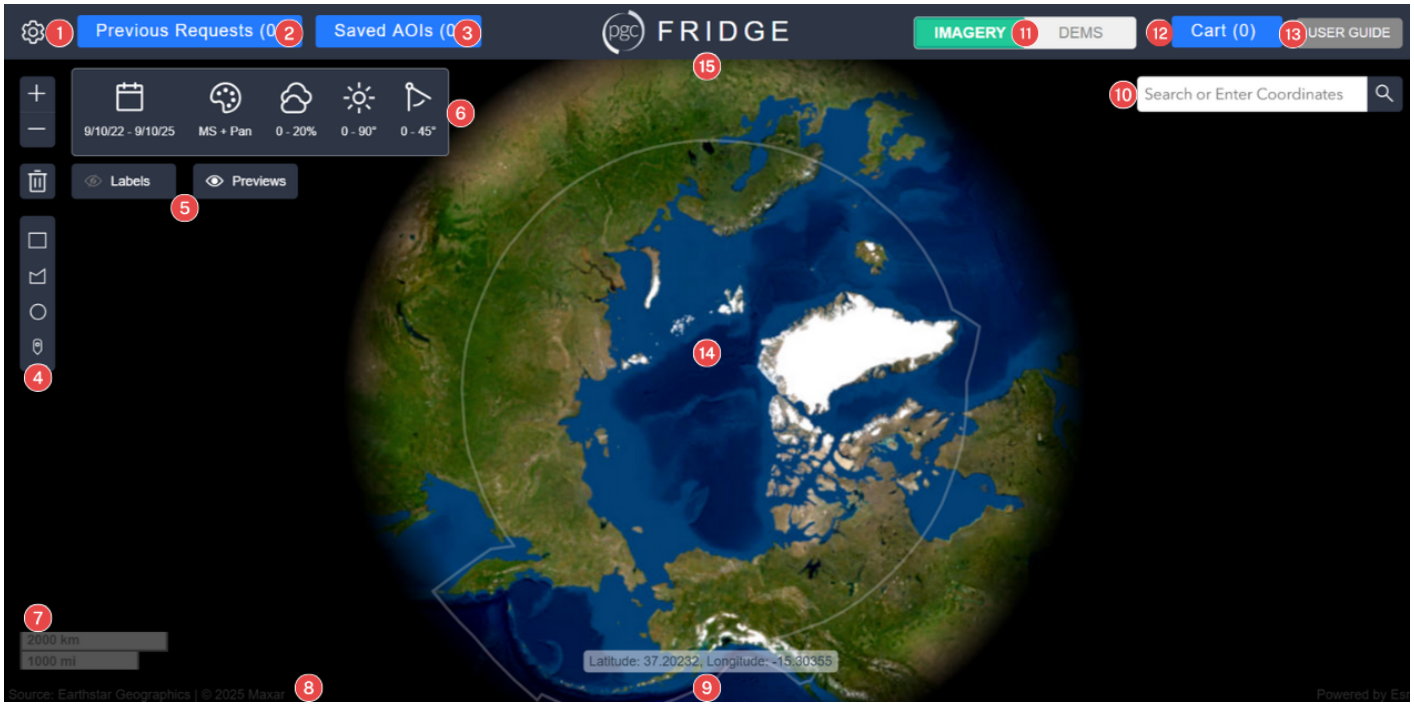


1. Users must first register and log in using their PGC User Account to access any Licensed Data, as required by EOCL licensing restrictions.
2. & 3. Once logged in, users must select the verified NSF award associated with their data request. If selected award spans multiple geographic regions, users must select a corresponding collection (Antarctica, Arctic, High Mountain Asia, Non-Polar). This important step ensures compliance with the EOCL license, which permits researchers to use the licensed data exclusively for their federal award during its active period. All data requests must align with the selected award to maintain licensing compliance.

> Find more information about licensing restrictions in the EOCL FAQ.

2. User Interface Overview

Upon launching the chosen regional collection of licensed data, users encounter a map-based interface with several essential components (**shown below is the interface for Arctic Collection, which includes imagery and Alaska ArcticDEMs**):



Main Screen Layout

#	*Item*	*Description*
1	Settings	Account logout, options to change award and collection selection, and access feedback form.
2	Previous Requests	History of previous requests including deliverable IDs, footprint downloads, and lists of files.
3	Saved AOIs	History of previous defined and saved Areas of Interests. Details include: time created, request name, and regional collection in which AOI was created. Options to download AOI shapefile, GEOJson, GeoPackage and restore to map display (at zoom level created).
4	Navigation Panel	Interact with the map window with zoom, trash/clear, and selection tools. Define an Area of Interest (AOI) by drawing a rectangle, polygon, radius, or location point using the map viewport. Delete AOI to restart. Save AOI for future use cases.
5	Map Display Options	View placename labels and imagery/DEM scene previews.
6	Query Panel	Query tools to manage various metadata parameters (determined by Data Toggle #11 in Arctic Collection). Imagery tools include: time, band selection (multispectral, panchromatic), cloud cover percent, sun elevation angle, off-nadir angle. DEM tools include: time, collection method (in-track, cross-track), and percent valid data. See *note* below for more information.
7	Scale Bar	Align the measurement with the bar to estimate the real-world distance (kilometers or miles).
8	Data Sources	Data providers of foundational basemap and geospatial layers.

#	Item	Description
9	Coordinates	View the map coordinates in decimal degrees (DD) at your cursor location. Use the PGC coordinate converter app to update your inputs to the correct DD format.
10	Search Location	Find specific locations or features by placenames or decimal degree (DD) coordinates.
11	Imagery or DEM Data Toggle (Arctic Collection only)	Green toggle indicates data type for selection, imagery or Alaska ArcticDEM strips (2022-present). The Query Panel (#5) will change according to selected data type.
12	Cart and Checkout	Add selected imagery/DEM scenes to the cart. Review cart items prior to ordering, imagery items require specific product formats in checkout. Configure imagery/DEM product format suited for the intended application. Reference the PGC image processing options and processing decision table to determine the optimal imagery format per use case. *Please note all selected scenes in cart will be processed according to the requested product specifications.*
13	User Guide	Link to FRIDGE User Guide documentation.
14	Map Window	View imagery/DEM scenes of the polar region selected in the central display.
15	Landing Page	Visit FRIDGE landing page.

3. Querying Data

Before users can perform other functions, such as querying or previewing data, users must define an **Area of Interest (AOI)**. Users can define an AOI in serveral ways including: drawing a rectangle, polygon, radius, or location point using the map viewport.

After users create an AOI, there is an option to **Save** AOIs and name them for future use (limited to 10 total). Saved AOIs can be downloaded as a shapefile, GEOJson, and GeoPackage.

Polar Imagery

The imagery query panel allows users to apply metadata parameters to better narrow selections.

- **Date selection:** Choose between **Set Time Range** or **Specify Months/Years** to constrict your search based on temporal needs.
- **Band selection:**Check the **Multispectral** box to include imagery with multiple layers of light (e.g. visible, infrared) and/or check the **Panchromatic** box to include high-resolution black-and-white imagery that shows fine details but lacks color information.
- **Cloud Cover Percent:**Filter the imagery based on the cloud coverage using the slide bar of percent coverage. Percentages are developed by the satellite company algorithm and apply to the entire image scene. Using the filter may exclude scenes with good coverage over an area but are cloudy

elsewhere. Snow may be mistaken as clouds.

- **Sun Elevation Angle**: The angle between the sun and the horizon, indicating how high the sun is in the sky when the image is collected (0-90°).
- **Off-Nadir Angle**: The direction pointing directly below a particular location or sensor, indicating the angle at which an image is collected (0-60°).

> Find more information in the Introduction to Satellite Imagery Guide

Alaska ArcticDEM

The DEM strip query panel allows users to apply metadata parameters to better narrow selections.

- **Date selection:** Choose between **Set Time Range** or **Specify Months/Years** to constrict your search based on temporal needs.
- **Cross-Track Filter:** Check the box to exclude cross-track DEMs. This tool allows users to restrict or expand their DEM search based on the stereoscopic imagery collection mode. A stereoscopic pair can also be acquired in cross-track stereo mode when the satellite completes at least one orbit between the two image collections. However, in-track stereo is more accurate because less will have changed in the target location between the two shots.
- **Percent Valid Data:** Filter the strip DEM dataset based on the data quality using the slide bar of percent valid data. In the context of strip DEM metadata fields, “valid” means pixels that are not identified as potentially erroneous data in the strip bitmask raster.

> Find more information about percent valid data in the PGC DEM Products Guide: Metadata

4. Ordering Data

The Cart allows users to review, manage, and finalize their data selections before checkout. It displays all deliverable requests, grouped by product type (**Imagery or Strip DEMs**). Each item in the cart includes key metadata and quality details to help users make informed decisions before requesting data in checkout.

Cart Sections

Deliverable Requests Panel (left side)

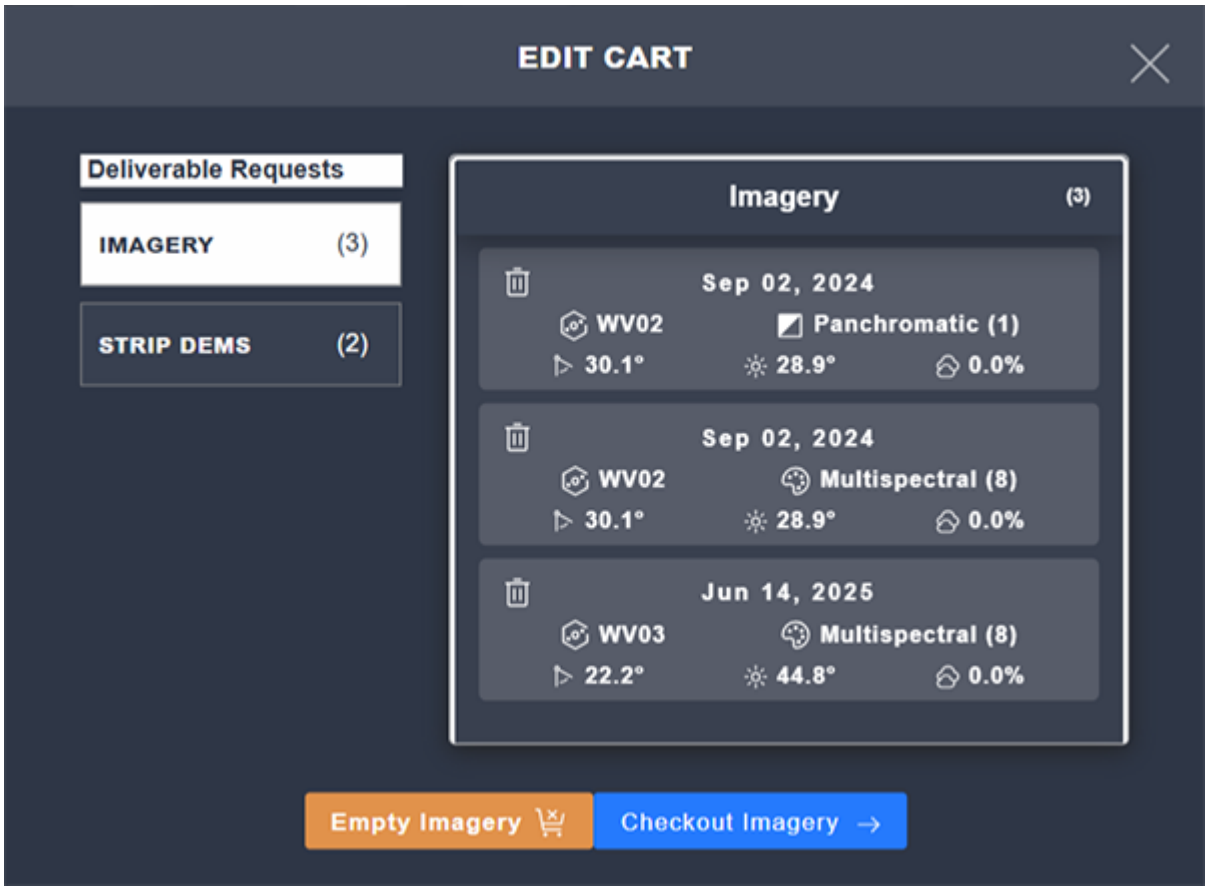
- Displays all product categories currently in the cart, such as **Imagery** or **Strip DEMs**
- The number in parentheses indicates how many items of each type are included
- Users can toggle between categories by clicking on the product type

item details panel (right side)

- Lists each selected dataset with its metadata and quality indicators
- **Imagery** metadata includes: acquisition date, satellite sensor, band, off-

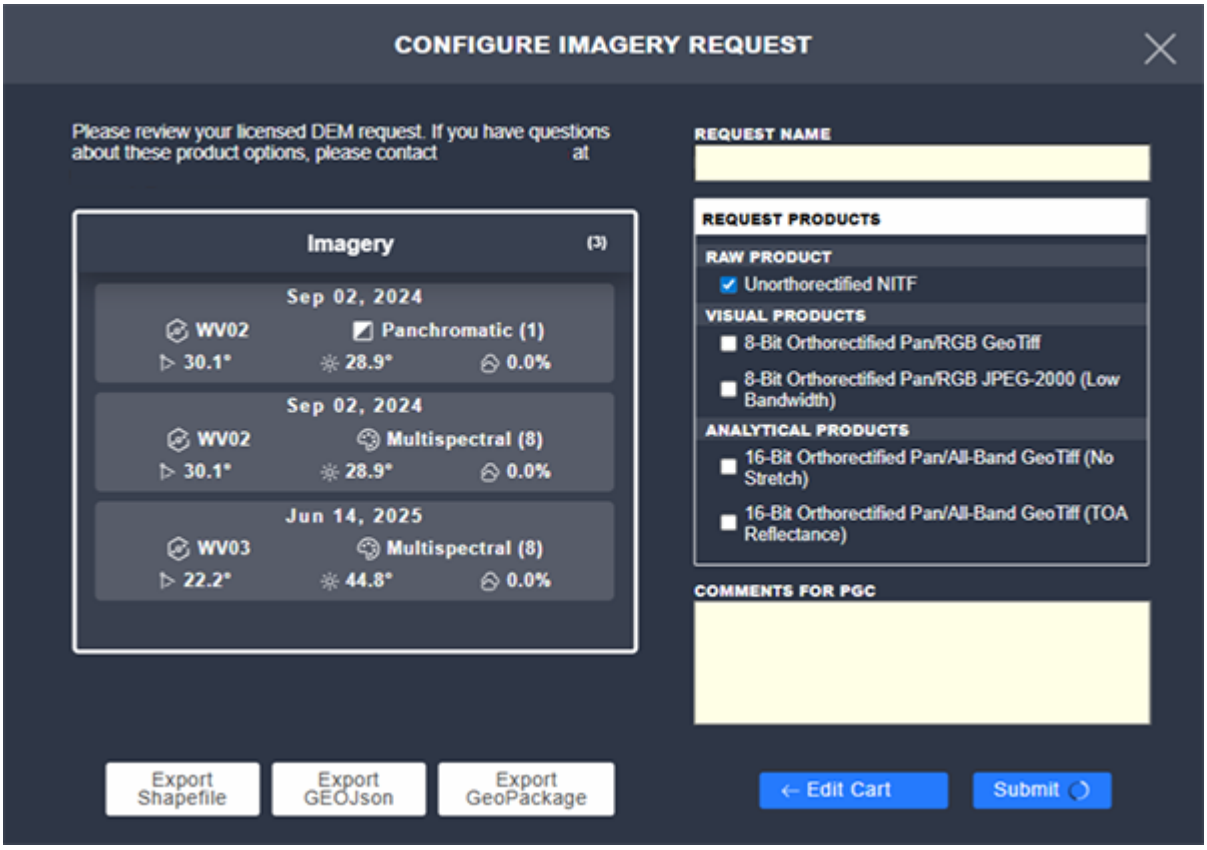
nadir angle, sun elevation angle, cloud coverage percentage

- **Strip DEM** metadata includes: acquisition date, satellite sensors of each image used, percent valid data, cross-track filter



After users select the data for ordering and added to the Cart, users are ready to configure and finalize their data requests before submission. **Imagery** products consist of processing operations applied to the selected scenes to enable analysis or mapping purposes. **Strip DEM** products are fromatted the same as Open Data elevation products from PGC, but since they require prior approval to share publicly, they are delivered to the user's private FTP folder to meet EOCL license requirements.

Configure Imagery Request



Users are encouraged to reference the following guides for additional information to support product decisions:

- PGC Image Processing Options
- PGC Imagery Processing Decision Tables

There are 5 standardized product options categorized into 3 application types that determine the output format for the entire cart. If users require multiple formats for the same selected imagery, users must submit separate orders.

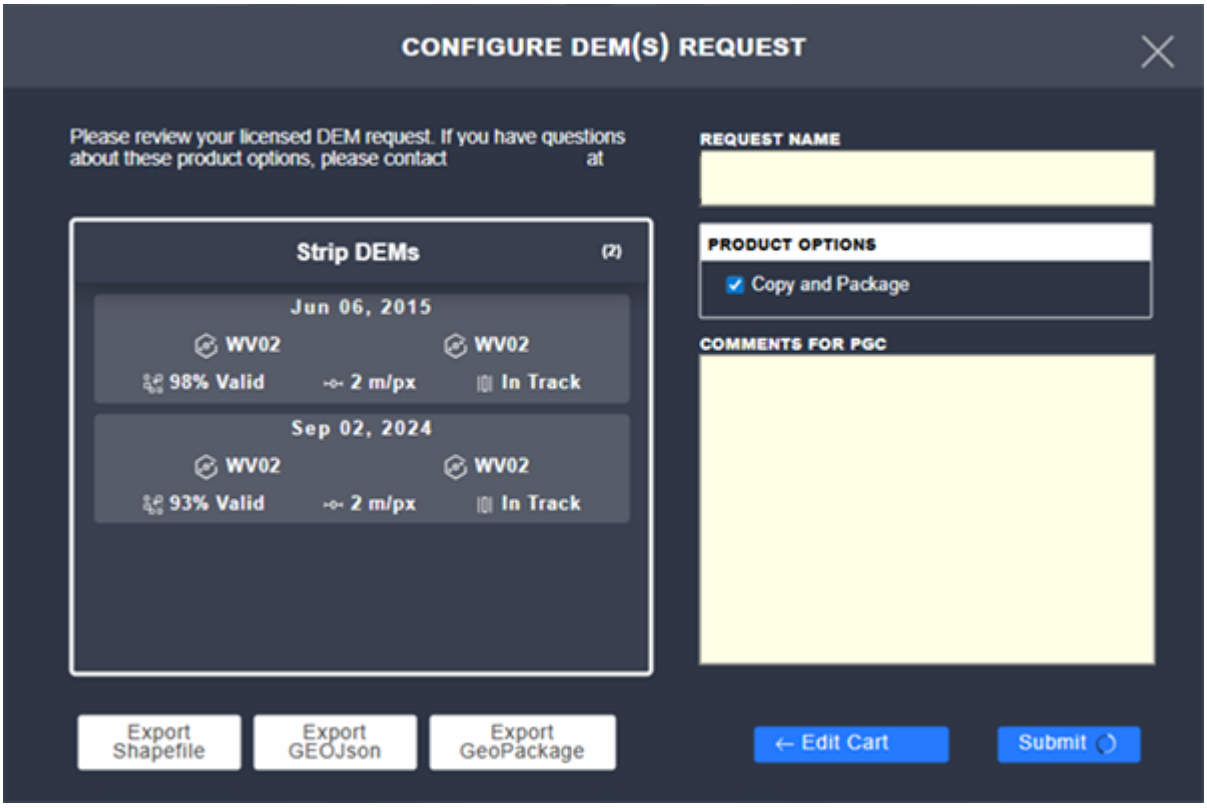
Raw Product
Unorthorectified NITF

Visual Products
8-Bit Orthorectified Pan/RGB GeoTiff
8-Bit Orthorectified Pan/RGB JPEG-2000 (Low Bandwidth)

Analytical Products
16-Bit Orthorectified Pan/All-Band GeoTiff (No Stretch)
16-Bit Orthorectified Pan/All-Band GeoTiff (Top of Atmosphere, TOA, Reflectance)

> *If different processing not readily available in FRIDGE are needed, users can add their needs within the comments section, or work with their listed PGC Point of Contact to determine the ideal processing parameters to receive the best product for the intended imagery application. This includes bulk data requests, as FRIDGE orders are limited to up to 500 images.*

Configure strip dem Request



Users requesting licensed Strip DEM(s) are packaged in the same format as PGC's Open Data elevation products (ArcticDEM), but cannot be publicly released without prior approval. To ensure compliance with the EOCL license, they are delivered to the user's private FTP folder.

Also available at checkout are download links to vector extents of the selection exported in Shapefile, GEOJson, or GeoPackage formats.

4.3 About Data Delivery

After a data order is submitted, it is reviewed by the user's PGC Point of Contact to ensure compliance with the EOCL license and scope of data request within the user's **selected federal award**. Once approved, the order runs through PGC automated processing pipeline and uploaded to the FTP space associated with the user's PGC User Account. Delivery times depend on multiple factors (order size, number in the queue, system maintenance, etc.) but are typically delivered within 1-3 days after submission. Users can reach out to their PGC Point of Contact for further order submission inquiries. Users are notified via email about their request status and completion.

> Find more information about suggested FTP clients in the PGC User Account guide

FAQ

Do I need a PGC account to access FRIDGE?

A PGC account is not required for Open Data Access. However, a registered PGC User Account with verified NSF Office of Polar Programs (OPP) award information is required for Licensed Data Access.

How do I create an account to access FRIDGE?

You must have an account with the Polar Geospatial Center in order to view the licensed datasets. If you

would like an account please visit the Request New Account page.

What does the EOCL License mean for commercial imagery I order from PGC?

Commercial satellite imagery received via FRIDGE ordering is subject under the EOCL License. Commercial satellite imagery obtained under the EOCL License should only be used for a U.S. Government purpose (which includes federally funded awards) and should not be made publicly available without NGA/NRO approval.

What does the EOCL License mean for high-resolution DEMs I access from FRIDGE?

ArcticDEM and Reference Elevation Model of Antarctica (REMA) accessed **via FRIDGE Open Data Access**:DEMs created under the ArcticDEM and REMA project (with the exception of Alaska June 2022-present) will continue to be openly available without restrictions.

Alaska DEMs accessed **via FRIDGE Licensed Data Access**: Alaska is the only region included in the ArcticDEM project domain that is not publicly releasable from June 2022-present under the current agreement between NGA, NRO, and NSF. These DEMs should not be made publicly available without NGA/NRO approval.

Please note: Custom DEMs you receive from PGC, outside of the FRIDGE platform, as well as DEMs you create yourself in support of your federally funded work have the same restrictions as commercial satellite imagery. Any DEMs created outside of the ArcticDEM and REMA project domains should not be made publicly available without NGA/NRO approval.

What is not allowed when using commercial satellite imagery from FRIDGE?

Prohibited Activities:

- Sharing or copying of imagery for purposes outside of the scope of the award
- Sharing of imagery with collaborators not funded under the award or collaborators at non-U.S. institutions
- Using the imagery after the term of an award has expired
- Posting the imagery to a public website without access controls, published paper, poster, etc.
- Sharing the imagery or imagery derived products with anyone planning to sell it or use it for commercial gain

Why is the preview image slow to load?

Although the application is optimized to display low resolution previews of selected data via the internet, slow internet connections can cause images to have some latency.

Can I access real-time data?

No, FRIDGE is not designed for real-time data access. PGC releases ArcticDEM and REMA data on an annual basis. If users with polar federal funding require more recent DEMs, they can contact their PGC Point of Contact for assistance. PGC's imagery archive requires many steps (identify, order, ingest, catalog, etc.) before it becomes available in FRIDGE. There is typically a delay of about one month from acquisition time to when a given image will be available in FRIDGE. PGC can order more recent data for users on an ad hoc basis, contact your PGC Point of Contact for requests. See also G-EGD Pro for the most recent Vantor (formerly Maxar) imagery collected.

Why am I finding elevation erros, negative values, or significantly different from expected (e.g. below sea level or off by tens of meters)?

The elevation values of ArcticDEM and REMA are referenced to the WGS84 ellipsoid and are not natively referenced to the geoid, orthometric heights, or Mean Sea Level. If you would like to convert these values to an approximation of mean sea level, follow our tutorial for details.

What is the maximum resolution of the imagery?

The resolution of an image depends on the imaging satellite it is collected from and spectral bands, but typically ranges from .3-.5 cm in panchromatic and 1.2-2 m in multispectral. See the Vantor Satellite Constellation guide for details.

Can I integrate FRIDGE data with my GIS software?

Yes, you can download DEMs or satellite imagery for use in ArcGIS Pro, QGIS, etc.

What if I need a processing option that isn't available in checkout (such as pansharpening, different file type, bulk amounts, etc.)?

Users are encouraged to reach out to their PGC Point of Contact listed or simply add a comment to your order at checkout noting what you need.

How can I provide feedback, report a bug or issue?

Please complete the feedback form provided in the settings menu on the FRIDGE page.

Feedback

PGC values user feedback to keep FRIDGE working, useful, and relevant to the user community needs. Please consider sharing any bugs/issues or feature requests by filling out the feedback form below.

FRIDGE FEEDBACK FORM

Contact

We're here to help! For further assistance, please reach out to the PGC team at pgc-support@umn.edu with any questions or comments.