

Oceans Melting Greenland

Multibeam Bathymetry Data User's Guide

Dataset

OMG Bathymetry MBES Level 2 Data

Authors

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Introduction

Global sea level rise will be one of the major environmental challenges of the 21st Century. Oceans Melting Greenland (OMG) will pave the way for improved estimates of sea level rise by addressing the question: To what extent are the oceans melting Greenland's ice from below? Over a five-year campaign, OMG will observe changing water temperatures on the continental shelf surrounding Greenland, and how marine glaciers react to the presence of warm, salty Atlantic Water. The complicated geometry of the sea floor steers currents on the shelf and often determines whether Atlantic Water can reach into the long narrow fjords and interact with the coastal glaciers. Because knowledge of these pathways is a critical component of modeling the interaction between the oceans and ice sheet, OMG will facilitate improved measurements of the shape and depth of the sea floor in key regions as well.

The bathymetry survey was primarily conducted using multi-swath Multibeam Echo Sounder System (MBES) equipment and procedures. MBES uses a sonar that produces an angular swath of beams to the port and starboard side in a single ping to effectively map a corridor with a width approximately 3-4 times the water depth. In addition to the multibeam echosounder, several more instruments are required on the vessel to georeference the raw multibeam data into corrected soundings. A GPS installed on the vessel is used to accurately position the location of the multibeam. Data from a pitch, roll, heave and heading sensor is used to correct the raw sounding based on the vessels attitude at the time the sonar ping. The sound velocity of the water column is required to convert the soundings from raw time-of-flight measurements to a corrected range as well as correct the sounding for refraction as it passes through the water column.

Campaigns

This data set consists of data from multiple campaigns.

2015 Terrasond Limited

This campaign was conducted by Terrasond Limited aboard the vessel M/V Cape Race. The data was collected during a survey of Greenland's Western coastline in July, August and September

2015 using the Teledyne Reson SeaBat 7160 Multibeam Echo Sounder System. See the field report https://podaac-tools.jpl.nasa.gov/drive/files/allData/omg/L2/docs/2015/Bathy-CTD-Terrasond/Appendix_A-Daily_Field_Reports.pdf for more details.

2016 Terrasond Limited

This campaign was conducted by Terrasond Limited aboard the vessel M/V Neptune. This data was collected during a survey of Greenland's Southeastern coastline in September and October 2016 using the Teledyne Reson SeaBat 7160 Multibeam Echo Sounder System. See the field report https://podaac-tools.jpl.nasa.gov/drive/files/allData/omg/L2/docs/2016/Bathy-CTD-Terrasond/Appendix_A-Daily_Reports.pdf for more details.

2016 Access Arctic / UCI

This campaign was conducted by Access Arctic along with the University of California, Irvine aboard the vessel S/Y Ivilia. The data was collected during a survey of Greenland's Western coastline in September 2016 using the Teledyne Reson SeaBat 7111 Multibeam Echo Sounder System.

2017 Access Arctic / UCI

This campaign was conducted by Access Arctic along with the University of California, Irvine aboard the vessel S/Y Ivilia. The data was collected during a survey of Greenland's Western coastline in August 2017 using the Kongsberg EM 710 Multibeam Echo Sounder System.

2018 Access Arctic / UCI

This campaign was conducted by Access Arctic along with the University of California, Irvine aboard the vessel S/Y Ivilia. The data was collected during a survey of Greenland's Southeastern coastline in August 2018 using the Kongsberg EM 710 Multibeam Echo Sounder System.

2019 Access Arctic / UCI

This campaign was conducted by Access Arctic along with the University of California, Irvine aboard the vessel M/V Aarii Moana. The data was collected during a survey of Greenland's Northwestern coastline in August 2019 using the Kongsberg EM 710 Multibeam Echo Sounder System.

2020 Access Arctic / UCI

A campaign was conducted by Access Arctic / University of California Irvine (UCI) aboard the M/V Aarii Moana vessel. The data was collected during a survey of Greenland's Southwestern coastline in March and April 2020 using the Elac Seabeam 1050 Multibeam Sonar.

A campaign was conducted by Access Arctic / University of California Irvine (UCI) aboard the M/V Wave vessel. The data was collected during a survey of Greenland's Northeastern coastline in August 2020 using the Bathyswath-2 Multibeam Sonar and Elac Seabeam 1050 Multibeam Sonar.

2021 Access Arctic / UCI

An in-situ campaign was conducted by Access Arctic / University of California Irvine (UCI). The data was collected during a survey of Greenland's Southwestern coastline in April 2021 using the Bathyswath-2 Multibeam Sonar.

A campaign was conducted by Access Arctic / University of California Irvine (UCI) aboard the M/V Wave vessel. The data was collected during a survey of Greenland's Northeastern coastline in August 2021 using the Bathyswath-2 Multibeam Sonar and Elac Seabeam 1050 Multibeam Sonar.

Format

The file names for this data set are of the form

"OMG_Bathy_MBES_L2_<time_coverage_start>.nc" where <time_coverage_start> is formatted as "YYYYMMDDhhmmss". The data files are in NetCDF format and are compliant with the Climate and Forecast (CF) Metadata Conventions. The data file is formatted as follows:

dimensions:

```
obs = UNLIMITED ; // (X currently)
```

variables:

```
double lat(obs) ;
```

```
lat:_FillValue = -9999. ;
```

```
lat:long_name = "latitude" ;
```

```
lat:standard_name = "latitude" ;
```

```
lat:units = "degrees_north" ;
```

```
lat:coverage_content_type = "coordinate" ;
```

```
lat:axis = "Y" ;
```

```
lat:valid_max = 90. ;
```

```
lat:valid_min = -90. ;
```

```
double lon(obs) ;
```

```
lon:_FillValue = -9999. ;
```

```
lon:long_name = "longitude" ;
```

```
lon:standard_name = "longitude" ;
```

```
lon:units = "degrees_east" ;
```

```
lon:coverage_content_type = "coordinate" ;
```

```
lon:axis = "X" ;
```

```
lon:valid_max = 180. ;
```

```
lon:valid_min = -180. ;
```

```
float altitude(obs) ;
```

```
altitude:_FillValue = -9999.f ;
```

```
altitude:long_name = "altitude" ;
```

```
altitude:standard_name = "altitude" ;
```

```
altitude:units = "meters" ;
```

```
altitude:positive = "up" ;
```

```
altitude:coverage_content_type = "physicalMeasurement" ;
```

```

altitude:coordinates = "lat lon" ;
altitude:grid_mapping = "UTM_Projection" ;
altitude:axis = "Z" ;
altitude:valid_min = -5000. ;
altitude:valid_max = 0. ;
double Xc(obs) ;
Xc:_FillValue = -9999. ;
Xc:long_name = "X-coordinate in UTM system" ;
Xc:standard_name = "projection_x_coordinate" ;
Xc:units = "meters" ;
Xc:coverage_content_type = "coordinate" ;
Xc:axis = "X" ;
Xc:valid_max = 834000. ;
Xc:valid_min = 160000. ;
double Yc(obs) ;
Yc:_FillValue = -9999. ;
Yc:long_name = "Y-coordinate in UTM system" ;
Yc:standard_name = "projection_y_coordinate" ;
Yc:coverage_content_type = "coordinate" ;
Yc:units = "meters" ;
Yc:axis = "Y" ;
Yc:valid_max = 9300000. ;
Yc:valid_min = 0. ;
char UTM_Projection ;
UTM_Projection:long_name = "UTM_Projection" ;
UTM_Projection:grid_mapping_name = "universal_transverse_mercator" ;
UTM_Projection:utm_zone_number = XXL ;

```

For every observation (obs), the latitude and longitude of the measurement are provided along with the elevation (altitude) represented in meters above sea level. The observation also includes the Universal Transverse Mercator (UTM) coordinates Easting and Northing, respectively. Each data file also includes several global variables to further describe the data contained within the file. These variables are as follows (values containing X's represent variables that have product specific values):

```

:title = "OMG Bathymetry MBES Level 2 Data" ;
:summary = "This file contains Multibeam Echo Sounder System (MBES) survey
swath measurements of seafloor depth on a regular grid collected as part of the OMG ship
survey. The MBES system collects data over a width of sea floor that is 3-4 times the water
depth along the ship track." ;
:keywords = "Bathymetry, Seafloor Topography, Water Depth" ;
:keywords_vocabulary = "NASA Global Change Master Directory (GCMD) Science
Keywords" ;
:Conventions = "CF-1.6, ACDD-1.3" ;

```

```

:id = "OMG_Bathy_MBES_L2" ;
:uuid = "XXXXXXXX-XXXX-XXXX-XXXX-XXXXXXXXXXXX" ;
:naming_authority = "gov.nasa.jp1" ;
:cdm_data_type = "Trajectory" ;
:history = "Transformed input product XXXXXXXXXXXXXXXXXXXX.XXX into NetCDF
format." ;
:source = "<campaign-specific>" ;
Terrasond Limited: "Bathymetry data collected with a Reson 7160 system
that employed a 1.5 degree along-track beam angle and a 2 degree
across-track beam angle, with 512 beams when operated in equidistant
mode. The nominal frequency of the sounder is 44 kHz, with an
operational range of 3 to 3000m."
2016 Access Arctic / UCI: "Bathymetry data collected with a Reson 7111
system."
2017/2018/2019 Access Arctic / UCI: "Bathymetry data collected with a
Kongsberg EM 710 system."
2020 (Spring) Access Arctic / UCI: "Bathymetry data collected with an
Elac Seabeam 1050 Sonar with a F180R (MRU at sonar head) and
Valeport mini SVS at sonar head."
2020 (Fall) Access Arctic / UCI: "Bathymetry data collected with a
Bathyswath-2 Sonar with SBG MRU, Hemisphere GNSS-vector and
Valeport SVP for depth and sound velocity at sonar head as well as an
Elac Seabeam 1050 Sonar with a F180R (MRU at sonar head) and
Valeport mini SVS at sonar head."
2021 (Spring) Access Arctic / UCI: "Bathymetry data collected with a
Bathyswath-2 Sonar attached on the Through Ice Multibeam (TIMB)
system."
2021 (Fall) Access Arctic / UCI: "Bathymetry data collected with a
Bathyswath-2 Sonar with SBG MRU, Hemisphere GNSS-vector and
Valeport SVP for depth and sound velocity at sonar head as well as an
Elac Seabeam 1050 Sonar with a F180R (MRU at sonar head) and
Valeport mini SVS at sonar head."
:platform = "<campaign-specific>" ;
2015 Terrasond Limited: "M/V Cape Race Vessel"
2016 Terrasond Limited: "M/V Neptune Vessel"
2016/2017/2018 Access Arctic / UCI: "S/Y Ivilia Vessel"
2019/2020 (Spring) Access Arctic / UCI: "M/V Arii Moana Vessel"
2020 (Fall) Access Arctic / UCI: "M/V Wave"
2021 (Spring) Access Arctic / UCI: "In Situ"
2021 (Fall) Access Arctic / UCI: "M/V Wave Vessel"
:instrument = "<campaign-specific>" ;
Terrasond Limited: "Teledyne Reson SeaBat 7160 Multibeam Echo
Sounder System (MBES)"

```

2016 Access Arctic / UCI: "Teledyne Reson SeaBat 7111 Multibeam Echo Sounder System (MBES)"

2017/2018/2019 Access Arctic / UCI: "Kongsberg EM 710 Multibeam Echo Sounder System (MBES)"

2020 (Spring) Access Arctic / UCI: "Elac Seabeam 1050 Multibeam Sonar"

2020 (Fall) Access Arctic / UCI: "Bathyswath-2 Multibeam Sonar and Elac Seabeam 1050 Multibeam Sonar"

2021 (Spring) Access Arctic / UCI: "Bathyswath-2 Multibeam Sonar"

2021 (Fall) Access Arctic / UCI: "Bathyswath-2 Multibeam Sonar and Elac Seabeam 1050 Multibeam Sonar"

:processing_level = "L2" ;

:comment = "<campaign-specific>" ;

2015 Terrasond Limited: "This data was collected during the 2015 survey of Greenland's Western coastline."

2016 Terrasond Limited: "This data was collected during the 2016 survey of Greenland's Southeastern coastline."

2016 Access Arctic / UCI: "This data was collected during the 2016 survey of Greenland's Western coastline."

2017 Access Arctic / UCI: "This data was collected during the 2017 survey of Greenland's Western coastline."

2018 Access Arctic / UCI: "This data was collected during the 2018 survey of Greenland's Southeastern coastline."

2019 Access Arctic / UCI: "This data was collected during the 2019 survey of Greenland's Northwestern coastline."

2020 (Spring) Access Arctic / UCI: "This data was collected during the 2020 survey of Greenland's Southwestern coastline."

2020 (Fall) Access Arctic / UCI: "This data was collected during the 2020 survey of Greenland's Northeastern coastline."

2021 (Spring) Access Arctic / UCI: "This data was collected during the 2021 survey of Greenland's Southwestern coastline."

2021 (Spring) Access Arctic / UCI: "This data was collected during the 2021 survey of Greenland's Northeastern coastline."

:standard_name_vocabulary = "NetCDF Climate and Forecast (CF) Metadata Convention" ;

:acknowledgement = "This research was carried out by the Jet Propulsion Laboratory, managed by the California Institute of Technology under a contract with the National Aeronautics and Space Administration." ;

:license = "Freely Distributed" ;

:product_version = "1.0" ;

:references = "DOI:10.5067/OMGEV-MBES1" ;

:creator_name = "Joshua K. Willis" ;

:creator_email = "Joshua.K.Willis@jpl.nasa.gov" ;

:creator_url = "https://dx.doi.org/10.5067/OMGEV-MBES1" ;

:creator_type = "Person" ;

```
:creator_institution = "NASA Jet Propulsion Laboratory" ;
:institution = "NASA Jet Propulsion Laboratory" ;
:project = "Oceans Melting Greenland (OMG)" ;
:program = "NASA Earth Venture Suborbital-2 (EVS-2)" ;
:contributor_name = "Access Arctic / UCI" ;
:contributor_role = "Access Arctic / UCI performed the survey in the field,
collected the data and performed the initial processing." ;
:publisher_name = "PO.DAAC" ;
:publisher_email = "podaac@podaac.jpl.nasa.gov" ;
:publisher_url = "https://dx.doi.org/10.5067/OMGEV-MBES1" ;
:publisher_type = "group" ;
:publisher_institution = "NASA Jet Propulsion Laboratory" ;
:geospatial_lat_min = "XX.XXXXXXXXXX" ;
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:geospatial_lon_min = "-XX.XXXXXXXXXX" ;
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:geospatial_lon_units = "degrees east" ;
:geospatial_lon_resolution = "0.000000000000001f" ;
:geospatial_vertical_min = "-XXX.XX" ;
:geospatial_vertical_max = "-X.XX" ;
:geospatial_vertical_resolution = "0.001f" ;
:geospatial_vertical_units = "meters" ;
:geospatial_vertical_positive = "up" ;
:time_coverage_start = "XXXX-XX-XXTXX:XX:XX" ;
:time_coverage_end = "XXXX-XX-XXTXX:XX:XX" ;
:time_coverage_duration = "PXXD" ;
:date_created = "XXXX-XX-XXTXX:XX:XX" ;
```

Citation

This research was carried out by the Jet Propulsion Laboratory, managed by the California Institute of Technology under a contract with the National Aeronautics and Space Administration. Use of this data should be cited as follows:

OMG. 2019. OMG Swath Gridded Multibeam Echo Sounding (MBES) Bathymetry. Ver. 1. PO.DAAC, CA, USA. Dataset accessed [YYYY-MM-DD] at <https://doi.org/10.5067/OMGEV-MBES1>.

Contact

For questions please email podaac@podaac.jpl.nasa.gov or visit the [PO.DAAC forum](#).

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