

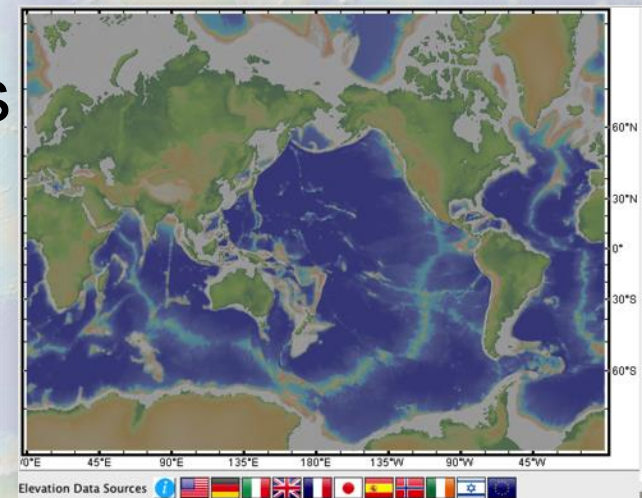
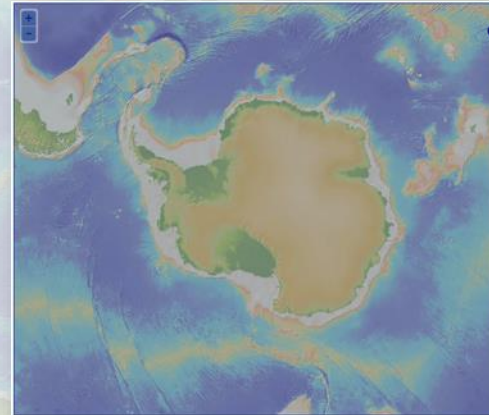
Global Multi-Resolution Topography Update

Vicki Ferrini, John Morton,
Mollie Celnick, Kevin McLain, Frank Nitsche,
Suzanne O'Hara, Suzanne Carbotte



Global Multi-Resolution Topography

- Dynamically maintained tiled synthesis
- Mercator, South Polar, North Polar
 - Images, Grids, Mask
- Comprehensive Metadata
 - Attribution
 - Access to source data
- Multiple Access Tools/Services
 - Web, Java, iOS, Web Services
 - Usage Statistics



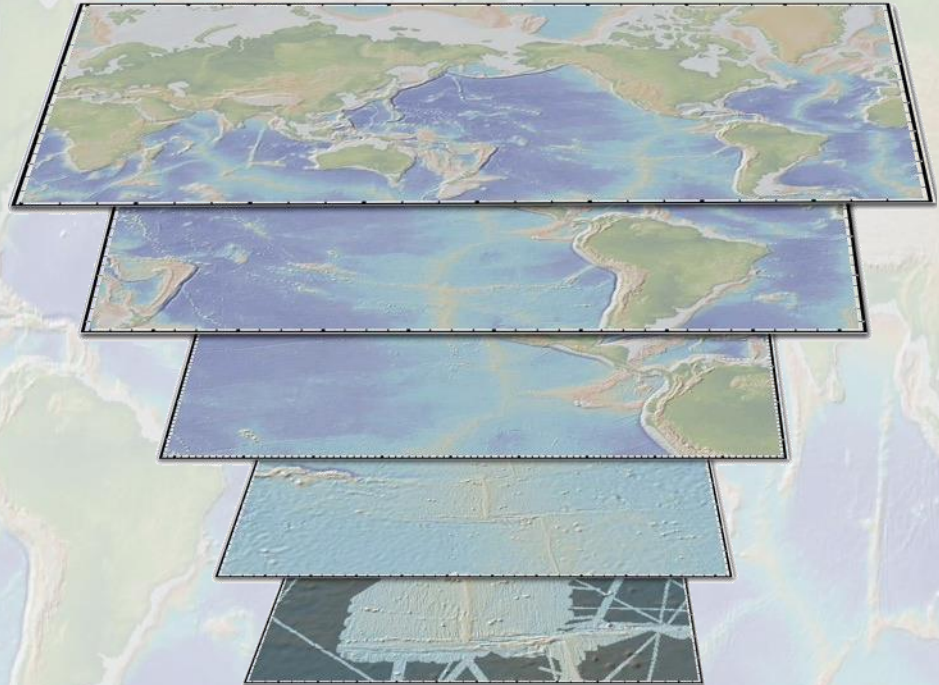
GMRT Grid Components

Land elevation
(30-10 m res)

Global & Regional
Grids (≥ 500 m res.)
e.g. *GEBCO_2014*

Contributed
Grids (< 500 m res.)

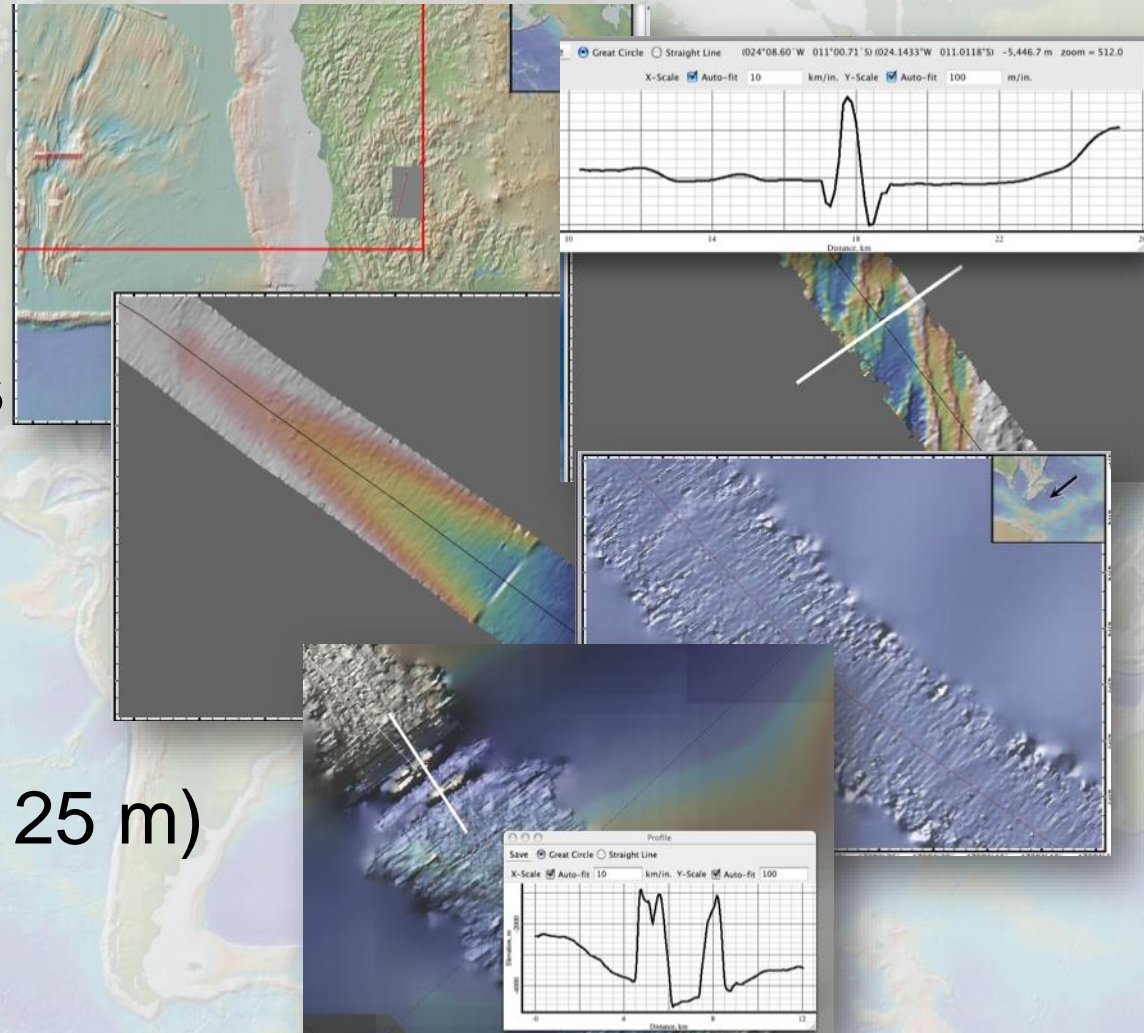
LDEO 100-m MB
compilation*



*LDEO team processes swath files (public domain, primarily US Academic)

Multibeam Data Preparation

- Bad navigation
- Bad soundings
- Instrument problems
- Sound velocity
- Attitude Offsets
- Grid weighting
- Resolution (**100**, 50, 25 m)



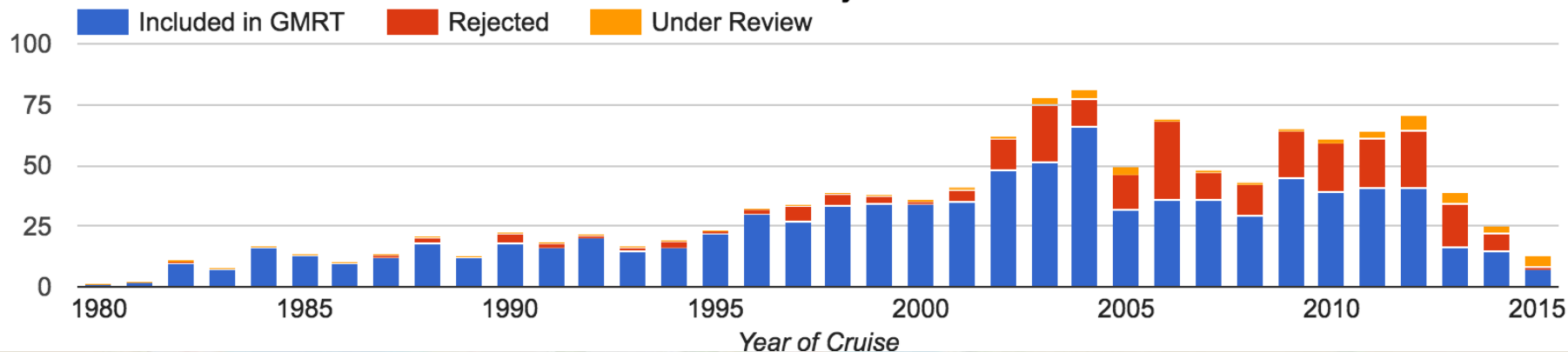
Processing leverages MB-System

2016: integrated QPS Qimera into data processing workflow

GMRT High-resolution Data

- Processed MB Data [GMRT v3.2]
 - Gridded to 100m resolution
 - 906 cruises
 - 26 ships
 - 187,045 swath files
 - 4.6 million ship-track km
 - 27 million km² (~ 8% ocean)

Cruises for which Swath Data were Reviewed and Processed by MGDS for GMRT















GMRT High-resolution Data

- 78 Contributed Grids
- Sources include:
 - NOAA
 - EMODNET
 - Scientists in 8 Nations
- Variable resolution
 - 100s m -> 1 m
- Data from Ships & Submersibles

Multibeam Surveys

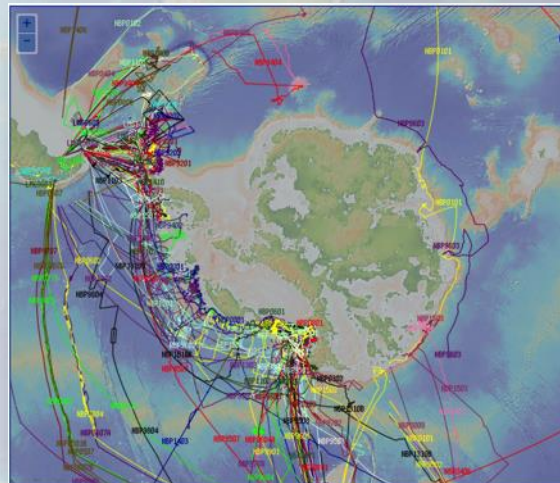
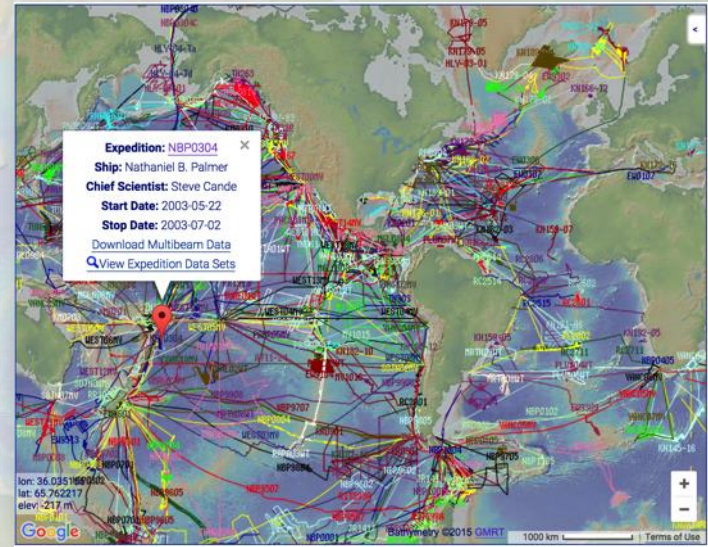
Contributed Grids

Surveys not included

-  [Aleutians \(TN182\)](#)
-  [American Samoa PIBHMC - Main \(SOEST\)](#)
-  [American Samoa PIBHMC - Swains Island \(SOEST\)](#)
-  [Antarctic Peninsula \(JR059\)](#)
-  [Arctic Compilation \(Flinders\)](#)
-  [Atlantic Coast Coastal Relief \(NOAA\)](#)
-  [Atlantic \(Rise Apron\) Margin \(LOS\)](#)
-  [Atlantic Slope \(NOAA-OE\)](#)
-  [Baltic Sea](#)
-  [Beringian Margin \(LOS\)](#)
-  [Black Sea \(Hall\)](#)
-  [Bosporus Shelf Canyons \(CIESM\)](#)
-  [Bowers Ridge \(LOS\)](#)
-  [Bowie and Hodgkins Seamounts \(NOAA\)](#)
-  [Canary Islands \(Watts\)](#)
-  [Caspian Sea \(Hall\)](#)
-  [Central America \(Weinribe\)](#)
-  [Chukchi Plateau \(LOS\)](#)
-  [EMODNET - Atlantic \(EU\)](#)
-  [EMODNET - Mediterranean \(EU\)](#)
-  [EPR - ABE \(Fornari\)](#)

GMRT – Web Map Services

- Three Projections
 - Mercator
 - South Polar
 - North Polar
- Multiple Components
 - Images
 - Masked Images
 - Tracklines
 - Grid extent



GMRT – RESTful Web Services

- Grid Service
- Attribution Service
- Image Server
- Point/Profile Service

Grid Download

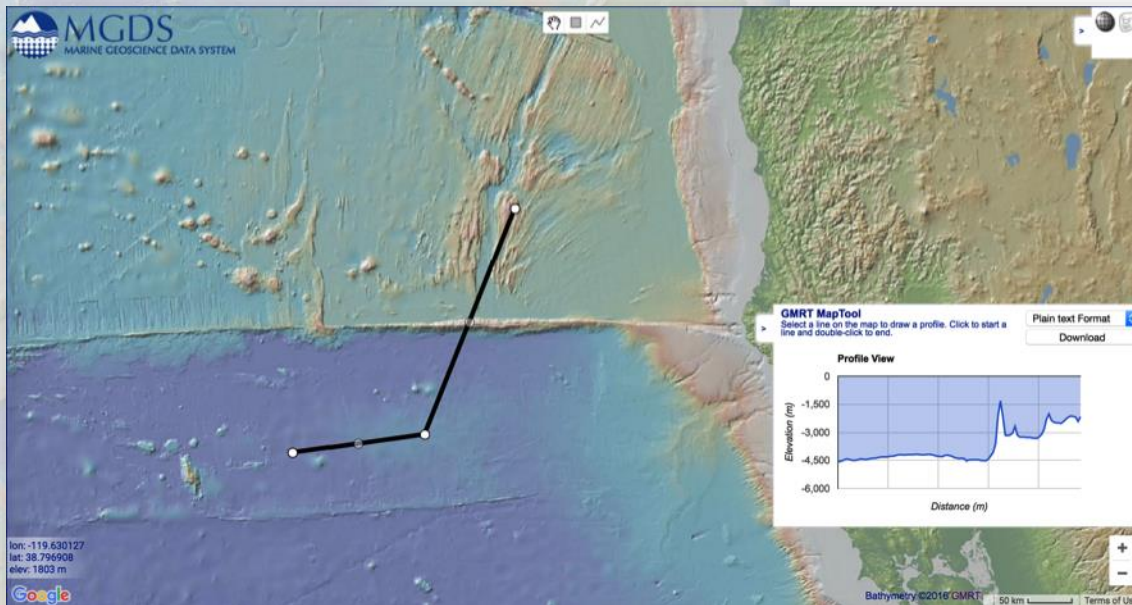
Citation Information
Ryan, W.B.F., S.M. Carbotte, J.O. Coplan, S. O'Hara, A. Melkonian, R. Arko, R.A. Weissel, V. Ferrini, A. Goodwillie, F. Nitsche, J. Bonczkowski, and R. Zemsky (2009). Global Multi-Resolution Topography synthesis, *Geochem. Geophys. Geosyst.*, 10, Q03014, doi: [10.1029/2008GC002332](https://doi.org/10.1029/2008GC002332)

File Format
 GMT v3 Compatible NetCDF (GMT id:cf) ?
 Coards/CF Compliant NetCDF (GMT id:nd) ?
 GeoTIFF ?
 ArcASCII ?

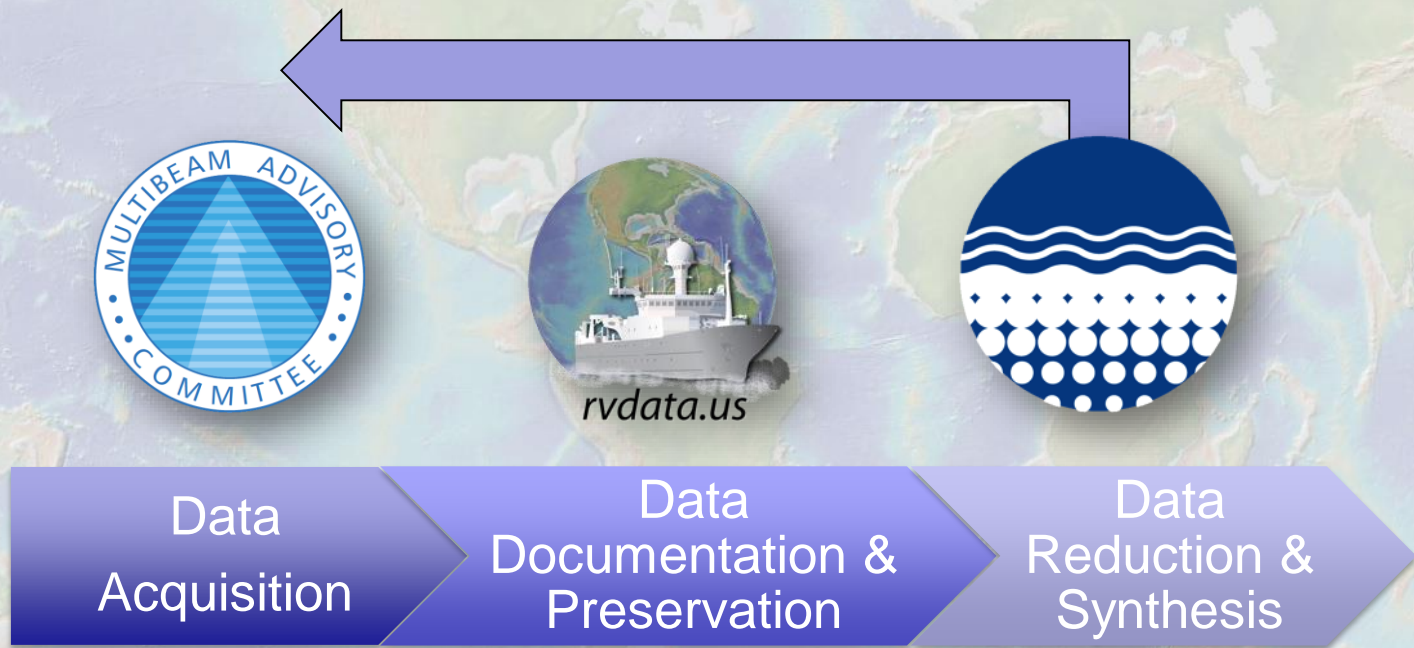
Mask
 Unmasked
 Masked
Unmasked grids are filled with GEBCO-2014 where high-resolution data do not exist in the ocean.

File Size: 810.4KB
Grid Resolution: 371.98 m/node
Grid Width: 751 nodes
Grid Height: 276 nodes
Bounds: West: -129.902344
East: -126.602051
South: 40.044438
North: 40.959989
Projection: Cylindrical Equidistant (WGS84 spheroid)
GMRT Version: 3.2 (Released June 2016)

Grid Resolution
dependent on size of selected area
 Low 371 m/node
File size: ~810KB
 Medium 185 m/node
File size: ~3MB
 High 92 m/node (May be supersampled)
File size: ~13MB
 Maximum 46 m/node (May be supersampled)



Integration and Coordination Across US Academic Fleet



Goal: Optimize data quality & promote best practices





MGL1212 (2012)

R/V Marcus G. Langseth 

Kongsberg EM122

Chief Scientist: W. Steven Holbrook

[Related Information at MGDS](#)

Data Summary

369 Data Files Processed (572 Reviewed)

65% of swath files were included in GMRT

Total Ship-Track Coverage: 1,430 km







Total Area Mapped: 8,698 km²

Data Processing Notes:

Roll bias added.



Rolling Deck to Repository (R2R)

-  Data Set Quality Rating
-  percent pings valid altitude
-  percent pings valid water depth
-  percent files all valid sonar draft
-  percent files with bathymetry
-  has surface sound velocity

Total number of raw swath files: 572

[View R2R QA Dashboard for MGL1212](#)

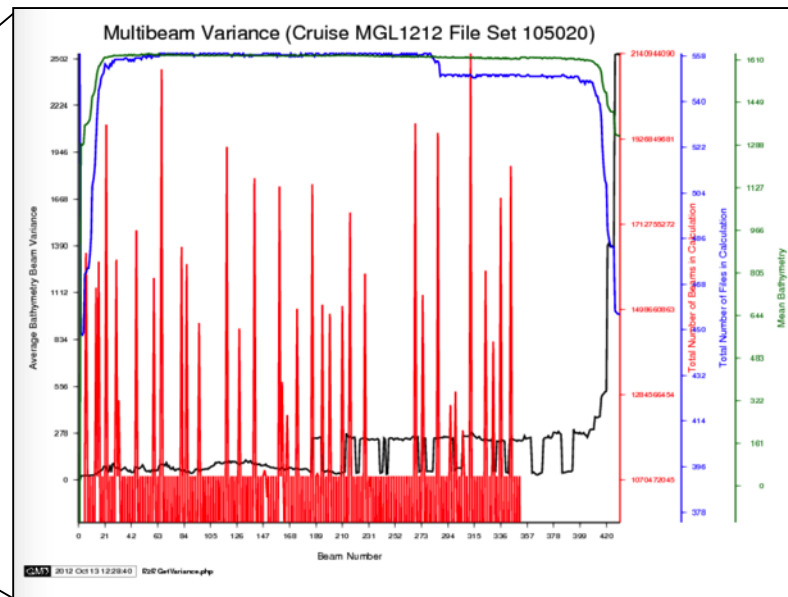
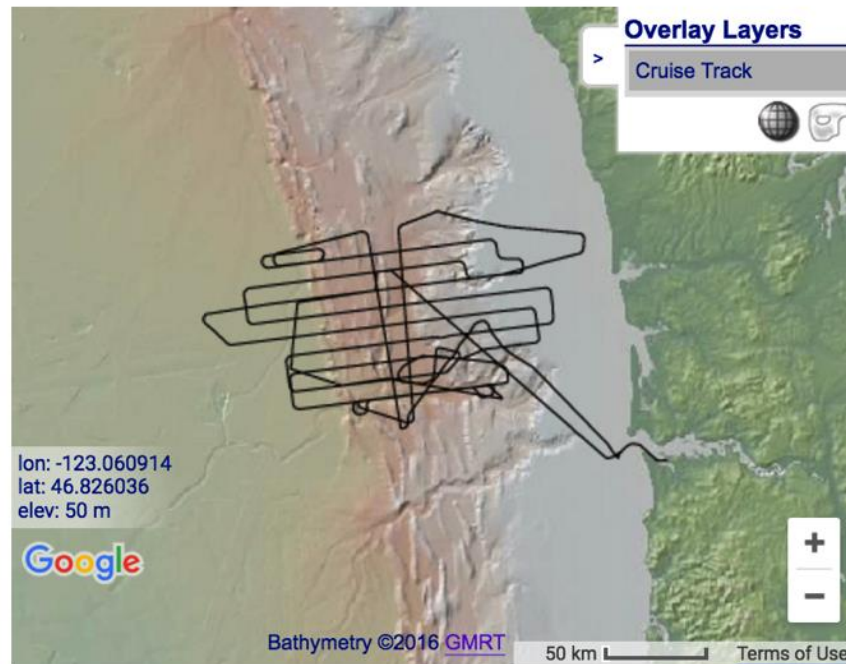
[View R2R QA Certificate \(XML\)](#)

[Download Raw Swath Files](#)



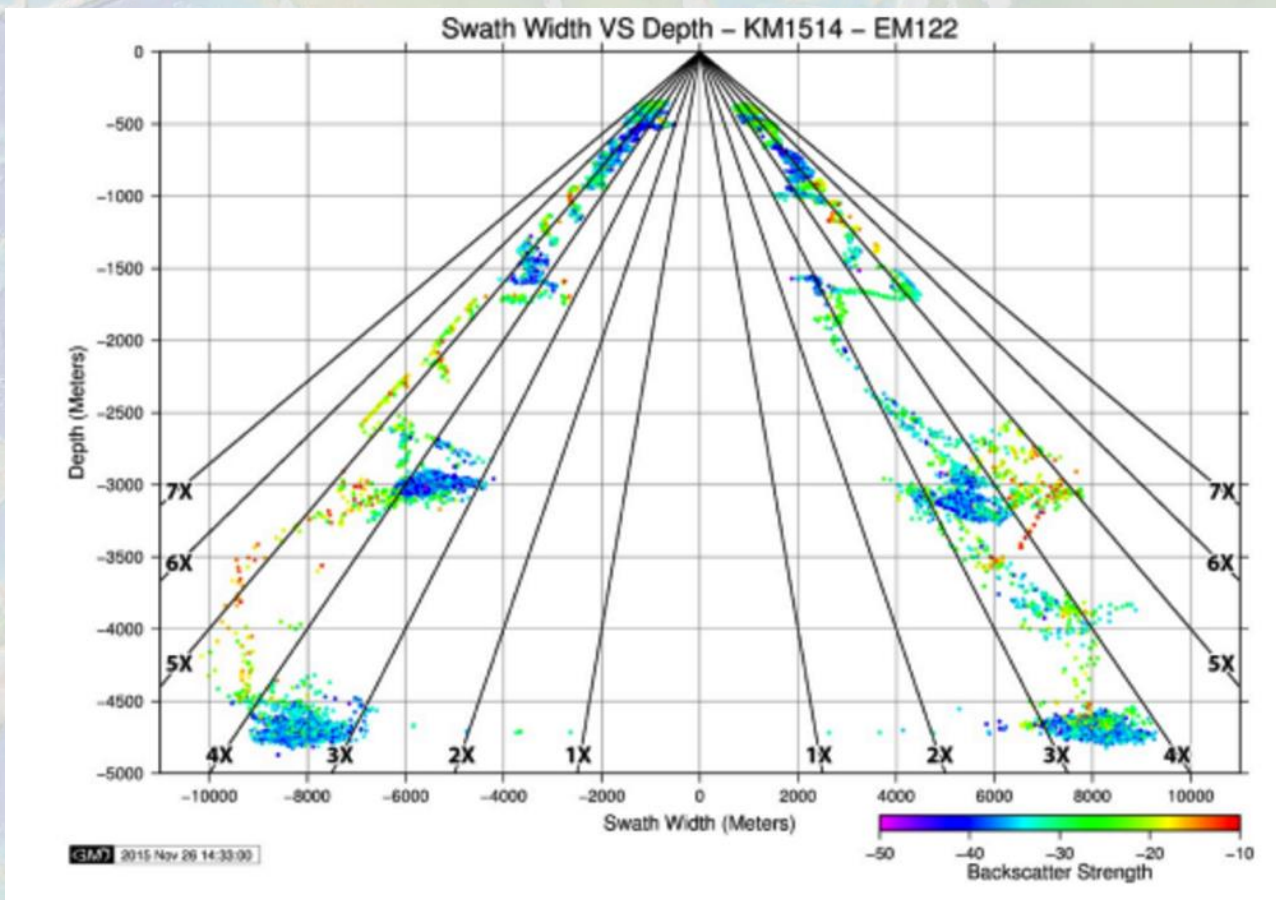
Multibeam Advisory Committee (MAC)

[MAC Resources](#)





Code-Sharing: Swath Coverage Analysis





Integration with GEBCO



- 2011
 - Gridded swath content [GMRTv2.0] supplied to GEBCO
- 2014
 - GEBCO_2014 release
- 2015
 - GEBCO_2014 integrated into GMRT basemap
- 2016
 - IBCSO integrated into GMRT SP basemap
 - Gridded swath content [GMRTv3.2] supplied to GEBCO
 - Processed swath files supplied for Indian Ocean Regional Compilation
 - IBCAO integrated into GMRT NP basemap



Broadening Access

- Disseminate gridded processed swath content
 - Google Ocean Basemap
 - 2011 & 2015
 - Google Earth Tour (400K views)
 - ESRI Ocean Basemap
 - *Release Pending*
 - *Story Map*
 - NOAA ECS request
- Increasing use of Web Services



Next Steps...

- GMRT v3.3 Release [Oct/Nov 2016]
 - NP basemap update
 - NP Web Services
- GMRT MapTool - Open Source
- Swath Coverage Analysis
- Test GMRT in the cloud
 - Costs & Performance ?
- GEBCO-HighRes [2017]

