

# TSCOM Activities and Preoccupations

Preliminary report  
11-13 December 2014  
Google Headquarters,  
Mountain View, California USA

# TSCOM Updates

- TSCOM membership
- New GEBCO\_2014 grid
- Release paper for GEBCO\_2014 grid
- GEBCO Data Store
  - Portal
  - Metadata
  - Data Sharing
  - User's Guide Cook Book Chapter
- GEBCO High-Resolution Product
- GEBCO Science Day is Special Session at 2014 Fall AGU Meeting
- Break-out Topics
- Highlights

# TSCOM Membership

## **Committee Members**

Jenifer Austin – Google Earth, USA

Vicki Ferrini – LDEO, USA

John Hall – Geological Survey of Israel

Timothy Kearns – OneOcean Corporation, USA

Karen Marks – NOAA, USA

Marzia Rovere – Istituto di Scienze Marine, Consiglio Nazionale delle Ricerche, Italy

Thierry Schmitt – SHOM, France

Walter Smith – NOAA, USA

Shin Tani – Hydrographic and Oceanographic, Coast Guard, Japan

Pauline Weatherall – British Oceanographic Data Center, UK

## **Scientific Advisors**

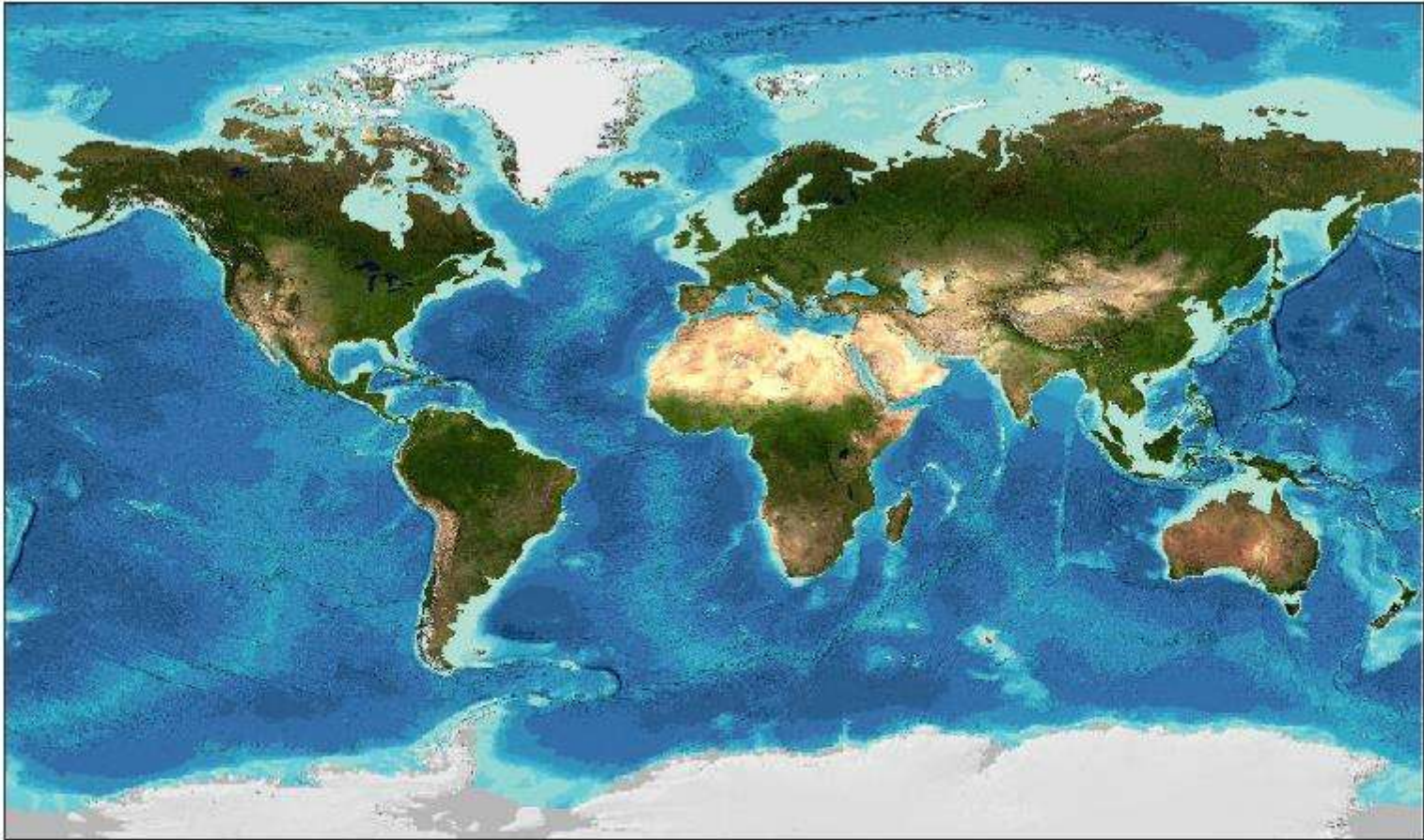
Paul Elmore, NRL, USA

Tony Pharoah, IHO, Monaco

Martin Jakobsson, Stockholm University, Sweden

David Sandwell, Scripps Institution of Oceanography, USA

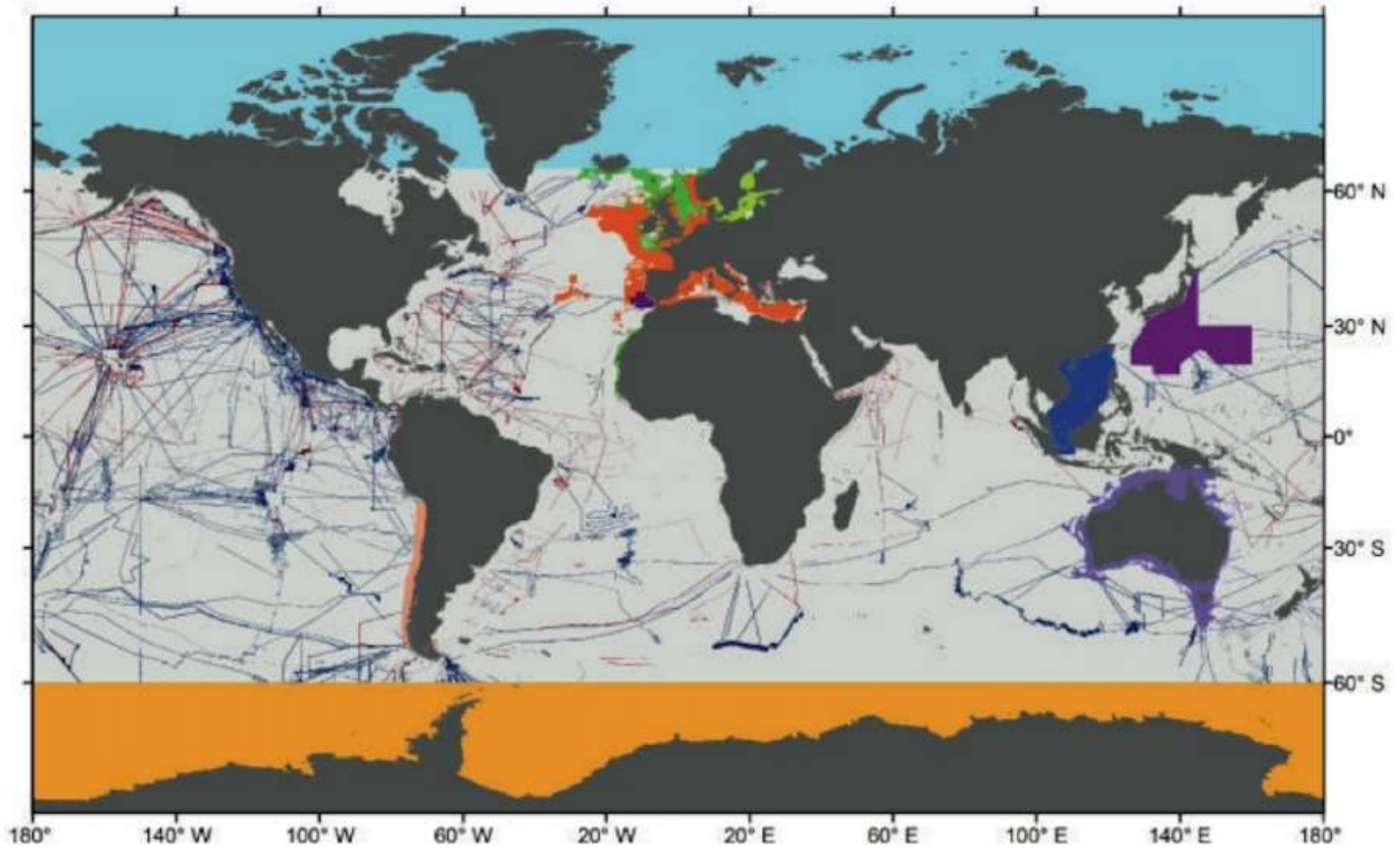
# GEBCO\_2014



Updated version of GEBCO global bathymetric grid released



# GEBCO\_2014



New data added since GEBCO\_08

# GEBCO\_2014

The screenshot shows the BODC website interface for the GEBCO 2014 data sets. The header includes the BODC logo, navigation links (Home, Contact us, Glossary, Site map, Site styles), a search bar, and user options (My account, Register, Log in). A secondary navigation bar contains links for About us, Data, Projects, Partners, Products, and Help and hints.

**Where to find data**  
Online delivery>  
All data series  
CTD profiles  
Current meter series  
Wave data series  
Argo floats  
CTD and underway data (AMT)  
Gridded bathymetry data (GEBCO)  
UK Tide Gauge Network  
Historical UK tide gauge data  
International sea level  
Numerical model data  
OPeNDAP/DODS server  
Historical BPR data  
Published Data Library>  
Information and inventories>  
Code and format definitions>  
Submitting data to BODC  
Portals and links>

## General Bathymetric Chart of the Oceans (GEBCO)

### Gridded bathymetric data sets

GEBCO's gridded bathymetric data sets are global terrain models for ocean and land. They are maintained and distributed by BODC on behalf of [GEBCO](#). The data sets include the

- [GEBCO\\_2014\\_Grid](#) — a global 30 arc-second interval grid
- [GEBCO\\_2014\\_Source\\_Identifier \(SID\)\\_Grid](#) — released to accompany the GEBCO\_2014 Grid
- [GEBCO\\_One\\_Minute\\_Grid](#) — a one arc-minute interval grid. Last updated in 2008, please note that there are no plans for further development of this data set.

The grids are available to download as either two-dimensional (2D) or one-dimensional (1D) array netCDF files. The 2D array grids use the [Climate and Forecast \(CF\)](#) metadata conventions. You can download data for a user-defined area or the complete global grid. The 1D array grids are for use with GEBCO's [Grid Display Software](#) and GEBCO Digital Atlas ([GDA](#)) and so are only available as a global grid. Find out more about the [file formats and software packages](#) that can be used to view and access the data sets.



Bathymetry data from the GEBCO\_2014 Grid

### Select your data set

From the table and map below, select your grid and the area of interest. Add your selection to the basket and repeat the process as required. Once you are happy with your selection(s) view the basket and checkout your request to start file preparation.

Use the '+' button in the top right-hand corner of the map to select to display the GEBCO Source Identifier (SID) Grid. It shows those grid cells for which the data in the GEBCO Grid are based on bathymetric sounding or grid values. It is best viewed at a zoomed in level to appreciate the detail in the data set.

Grid	Available area selection options	netCDF format	Select
<a href="#">GEBCO_2014_Grid (30 arc-second interval)</a>	User defined area or global grid	2D netCDF	<input type="checkbox"/>
	Global grid	1D netCDF	<input type="checkbox"/>
<a href="#">GEBCO_2014_Source_Identifier (SID)_Grid (30 arc-second interval)</a>	User defined area or global grid	2D netCDF	<input type="checkbox"/>
	Global grid	1D netCDF	<input type="checkbox"/>
<a href="#">GEBCO_One_Minute_Grid (1 arc-minute interval)</a>	User selected area or global grid	2D netCDF	<input type="checkbox"/>
	Global grid	1D netCDF	<input type="checkbox"/>

New download interface

# GEBCO\_2014 Release Paper

- Manuscript documents history, data sources, construction of grid; scientific results
  - “A new digital bathymetric model of the world’s oceans”
  - by “GEBCO\_2014 Compilation Team”
  - DOI number
- Submit to new AGU Earth and Space Science Journal
  - Publication fees waived through Dec. 31, 2014
  - Technical Report
- Eos “News Brief” planned

# GEBCO Data Store

- A repository for bathymetric trackline and gridded data used to produce the GEBCO grid
- Differs from other data repositories because it seeks already-processed data; preserves users efforts
- Data contributions:
  - Public (free, open access)
  - Already processed and/or gridded/decimated
  - Grid cells flagged with constraint information
  - Metadata
  - Attributed to source organizations to encourage contributions
  - Low resolution versions of proprietary high res data
- Two-way access to data
- **TSCOM seeks to make contributing data simple, easy, and painless**



# GEBCO Data Store is part of IHO DCDB

All Bathy/Relief

Coastal

DEM Portal

Fishing

Global

Lakes

Multibeam

NOS



Search GEODAS

## Databases:

GEODAS

Hydrographic Surveys

## Data Submission

The IHO DCDB can accept data via File Transfer Protocol (FTP), e-mail, CD and DVD as well as other mutually agreed upon digital media. Data are preferably in the MGD77 exchange formats, but any well documented format is acceptable.

Mailing Address:  
NOAA/NGDC  
E/GC3 325 Broadway  
Boulder, CO USA 80305-3328

## IHO Data Center for Digital Bathymetry (IHO DCDB)

The National Geophysical Data Center in Boulder, Colorado, USA, operates a worldwide digital data bank of oceanic soundings on behalf of the Member Countries of the [International Hydrographic Organization \(IHO\)](#). The IHO is based in Monaco and presently has approximately 60 Member Countries. An initial proposal was forwarded to the IHO jointly from the National Ocean Service, NOAA, and the US Defense Mapping Agency recommending formation of an international data center. On June 1, 1990, the IHO Data Center for Digital Bathymetry (DCDB) was officially established. Since that time, the IHO DCDB has made substantial progress toward establishing itself as the focal point for digital hydrographic data services for IHO Member Countries.

## DATABASES

The worldwide digital data bank of oceanic soundings are maintained in several data bases, including the GEODAS global marine geophysical data base, and the Hydrographic Survey Data System. The NOSHDB (National Ocean Service Hydrographic Database) is a subset of the Hydrographic Survey Data System.

## SERVICES PROVIDED BY THE IHO DCDB

The following services are provided by the NGDC on behalf of the IHO:

1. Operation of the data center with a focus of activity on oceanic regions with depths greater than 100 meters.
2. Provision, free of charge to the IHO for use by its Member Countries, of the data needed for their national or international projects. IHO Member Countries' Hydrographic Offices are requested to provide the IHO DCDB with digital bathymetric data collected by their nation's institutions in oceanic regions.
3. Maintenance of a quality control facility whereby data provided to the IHO DCDB are checked for violation of physical principles (*e.g.*, instantaneous changes in ship position, high ship speeds) and completeness of metadata for contributed cruises.
4. Maintenance of inventories in digital form of all digital bathymetric data held in the data center.
5. Collaboration with various international organizations in the developments of exchange formats and standards to expedite bathymetric data exchange.

## Related External Links:

[International Hydrographic Organization \(IHO\)](#)

[GEBCO](#)

[International Ocean Mapping](#)

IHO DCDB is worldwide digital data bank of oceanic soundings

# Chameleon Web Application Tool

## Chameleon: The NOAA Forms Editor

Version 0.7.5



Log In

Forms

Click here to view filled-out forms, or login to start filling out your forms.

### Why Chameleon?

Every scientist recognizes the critical role that dataset metadata plays in the access, understanding, exploitation and archiving of their data for future generations (or should by now!)

But modern metadata standards are managed in XML, a cryptic language that scientists don't always speak. This inhibits even the savviest scientist or data manager from documenting their data. Not to mention the folks in the field who are so busy collecting the data that they hardly want to spend time learning XML.

Until now, building a customized form-based metadata editor that's easy to use required hiring an (expensive) programmer. Even after it was done, making the slightest change required pleading for indulgence from your programmers, followed by waiting a week while the change was deployed to your production environment, sigh!

So for the EMMA Enterprise Metadata Management Architecture we use in NOAA, we decided to eschew the programmers. Now all you need to build your own custom form editor(s) is basic knowledge of XML and HTML (and optionally Javascript). Our builder is implemented using XSLT, a kind of XML template language, that's fast and easy to learn for the purposes of this editor builder. Changes to your editor are instantly visible, requiring no tedious deployment process.

[National Geophysical Data Center \(NGDC\)](#)

<http://www.ngdc.noaa.gov/cedit>

- Enables contributors to easily create acceptable metadata and submit data through an HTML form
- Gathers information for data discovery, flag Source Identifiers (SID), and automatically generates high quality, ISO compliant metadata

# Create Metadata and Submit Data

Home New FormContent **GEBCO Data Store**

Filter by CONTENT:

## FormContent List

Actions	Description	Last Updater	Last Updated	Date Created
<a href="#">Show</a> <a href="#">Edit</a>	<a href="#">Geoscience Australia 50 m grid tile SJ49</a>	karen.marks@noaa.gov	2014-11-07 09:38:41 MST	2014-11-07 09:31:47 MST
<a href="#">Show</a> <a href="#">Edit</a>	Pending	daniel.price@noaa.gov	2014-11-06 13:10:59 MST	2014-11-06 09:46:01 MST

## GEBCO DATA STORE

**How To Use This Form:**  
instructions on use of this form are forthcoming.

**METADATA FOR BATHYMETRIC DATA SET**

**ENTER METADATA FOR CONTRIBUTED GRIDS AND OTHER BATHYMETRIC DATA SET**

\*BATHYMETRIC DATA TITLE

\*ORIGINATING COMPILATION NUMBER

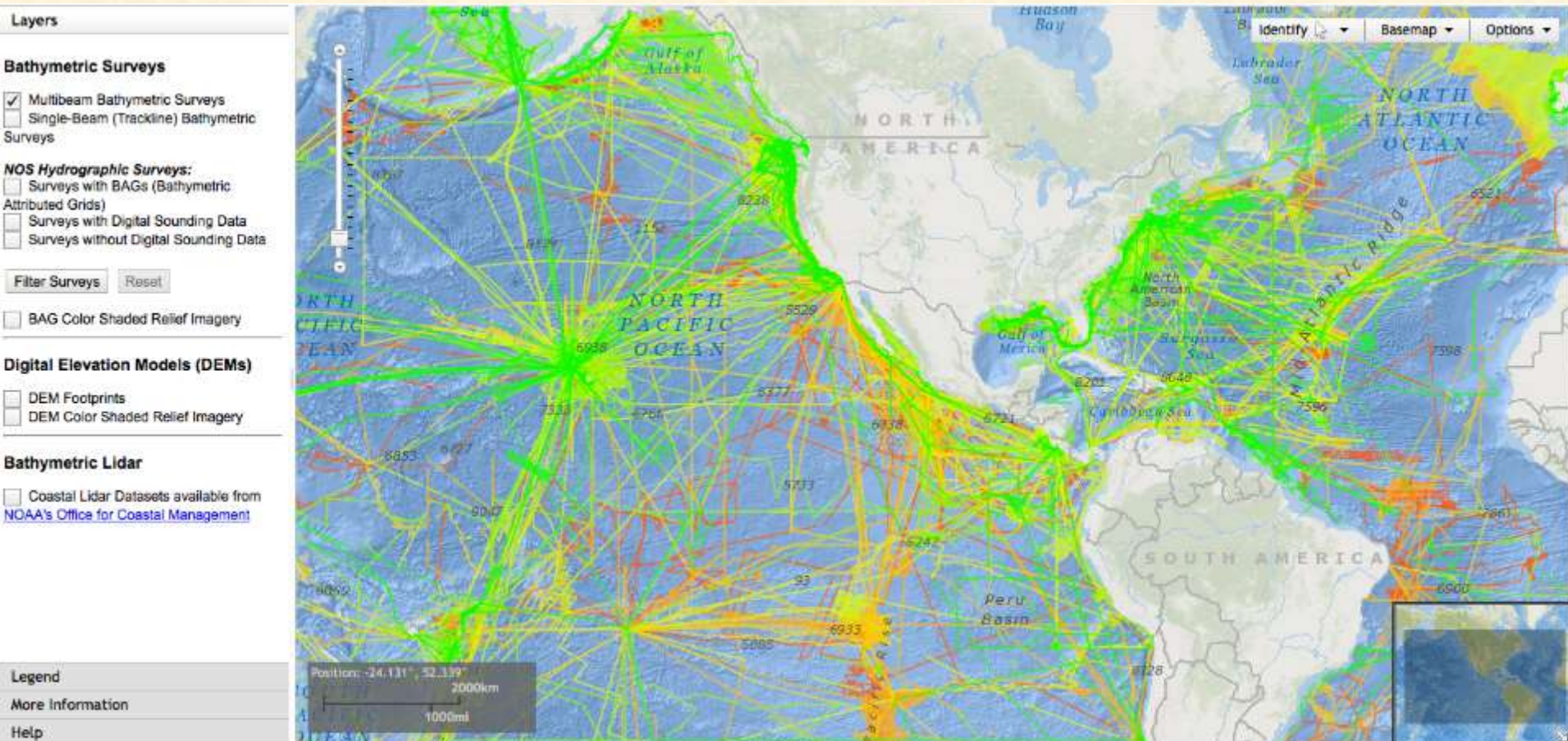
\*ORIGINATING VERSION NUMBER

\*ABSTRACT/PURPOSE(include information for gridded data sets on grid spacing and method used to generate gridded data set)

**Uploaded Files:**  [sj49.test.xyz](#)



# Planned- GEBCO Data Store layer

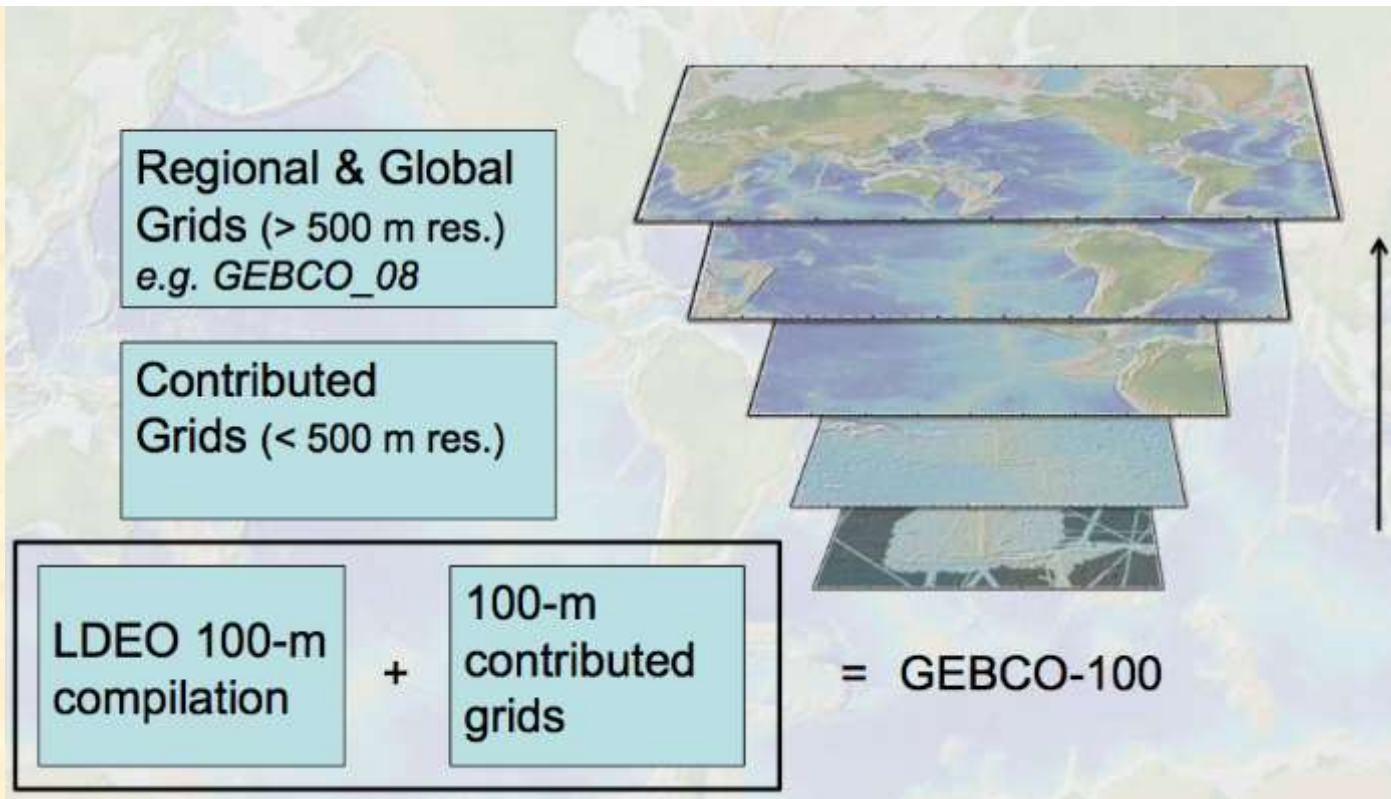


Find and download GEBCO Data Store data via interactive map interface



# GEBCO Hi-Res Product

- **GEBCO Hi-Res** is a prototype effort to create a new high resolution GEBCO product
- **Global Multi-Scale Resolution Topography (GMRT)** is a synthesis of terrestrial and seafloor elevation data in image and grid form that can be viewed in various resolutions
- GEBCO\_08 grid is combined with LDEO compilations and contributed grids
- Users can zoom-in, view data attributes, and access data



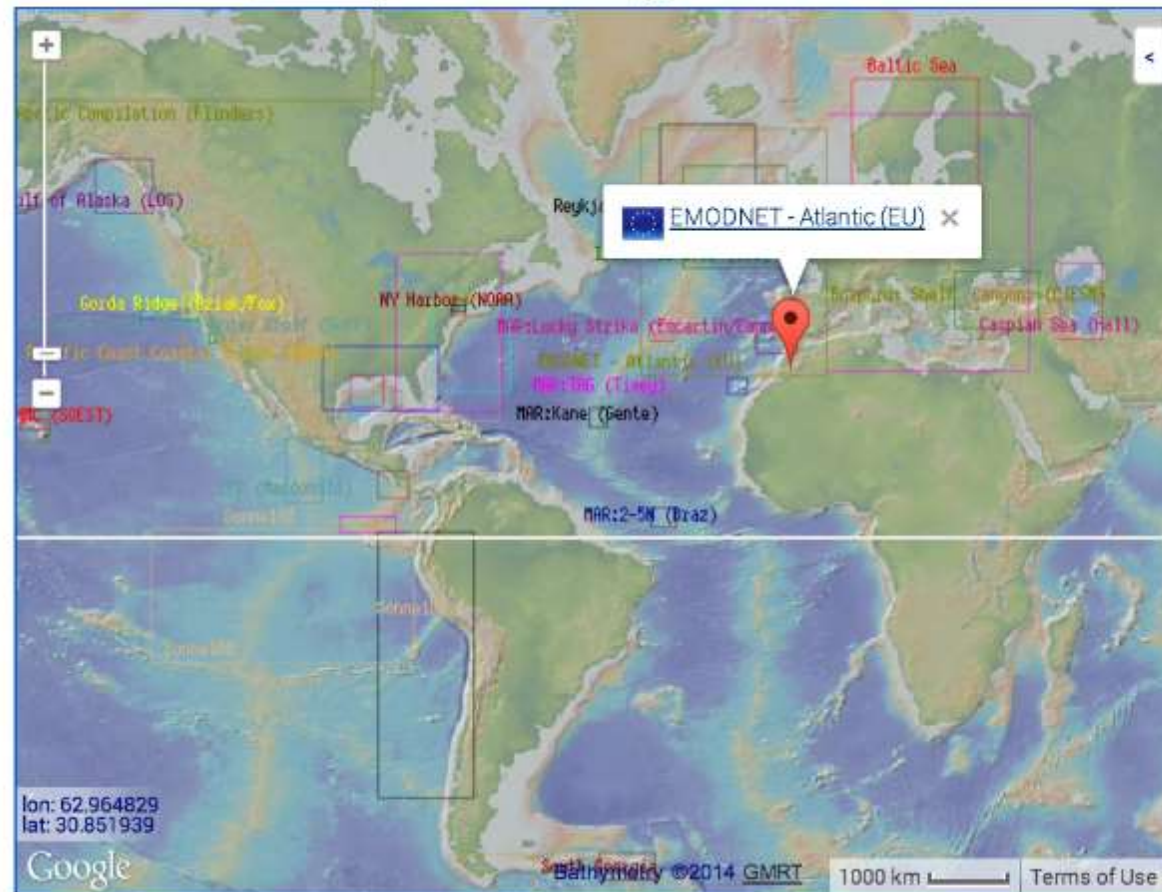
Regional mapping

ISCRUM

Mapping projects

## GEBCO High-Res

GEBCO High-Res is a prototype effort to create a new high-resolution GEBCO data product. Data currently displayed in the map include 100-m data from the LDEO GMRT synthesis as well as several contributed grids provided by international colleagues. Use the map to explore data sources and contributors. Please [contact us](#) with comments or suggestions.

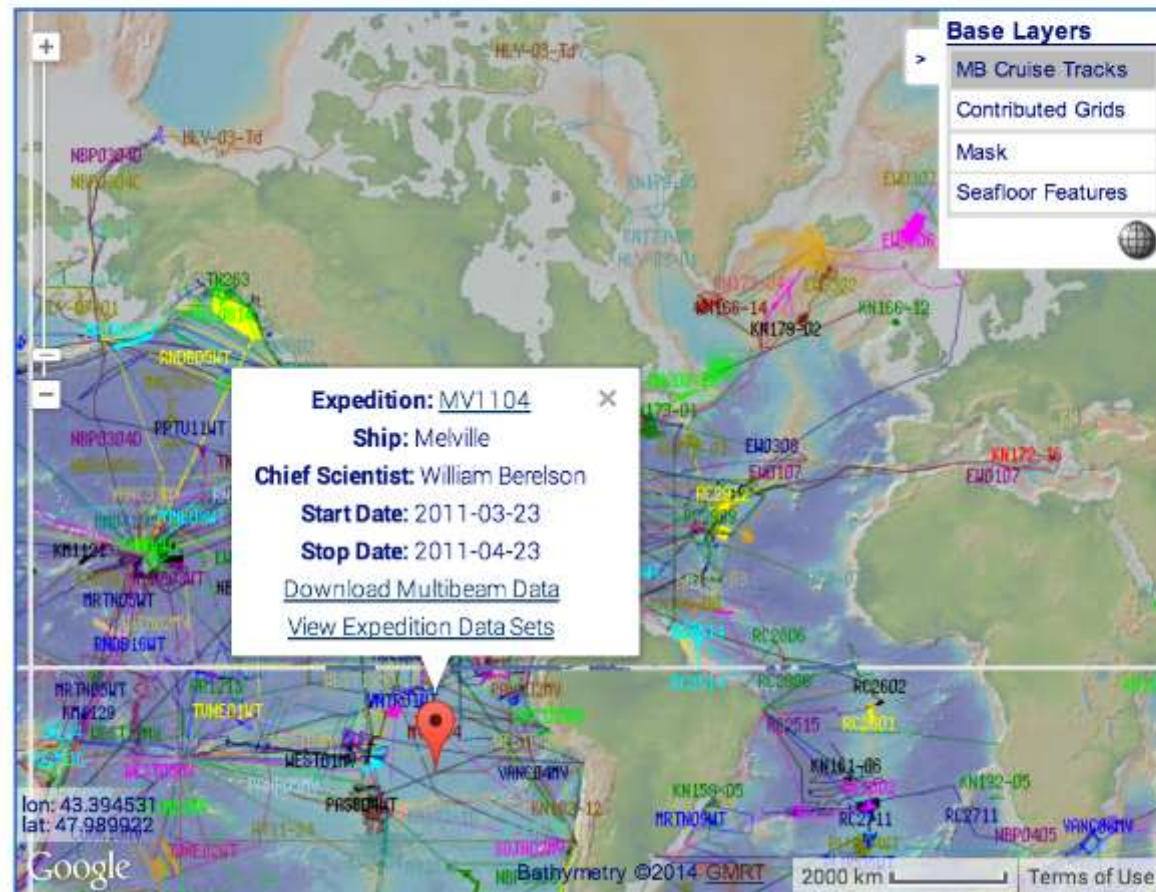




Regional mapping  
ISCRUM  
Mapping projects

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# GEBCO Bathymetric Science Day at Fall 2014 AGU Meeting Special Session

**AGU FALL MEETING**

San Francisco | 15–19 December 2014

BRANCH

BROWSE BY SECTION OR  
FOCUS GROUP

BROWSE BY CONVENER

## New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping

Session ID#: 1702  
Session Description:

Morphologic details of the ocean floor are revealed in high-resolution bathymetric maps derived from data collected by a variety of sensors, from echo-sounders, lasers, and multi-beam sonars to satellite altimetry. As the resolution of these systems increases, the details of seafloor structure that they reveal provide new insights into a range of seafloor, oceanographic, and tectonic processes. New advances in mapping and data processing may further enhance these interpretations. This session invites contributions from studies using high-resolution seafloor mapping, including regional and global data, as well as innovations in methods of compilation, gridding, uncertainty analysis, and display techniques that lead to enhanced interpretation. We seek contributions dealing with a wide range of applications including, but not limited to, high-resolution seafloor imagery revealing new perspectives on glacial landforms, tectonic processes, bottom currents, sediment dynamics, and biotic habitats.

Index Terms:

1008 Oceanography (BP-OCEANO) [30]  
3045 Seafloor morphology, geology, and geophysics [MARINE GEOLOGY AND GEOPHYSICS]  
4560 Topographic/bathymetric interactions [OCEANOGRAPHY-IMPACT]

Primary Convener:

Paul A. Elmore  
pael@ucsd.edu

Host Research Lab:  
Marine Geoscience Division  
Science Support Center, UC, (David Steyer)

## New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping

- Wednesday, Dec. 17, 2014
- Ocean Sciences sessions OS31A, OS31B, OS33A, OS34D
- 16 oral and 29 poster presentations
- Conveners
  - Paul Elmore- Primary Convener
  - Jenifer Austin
  - Martin Jakobsson

**AGU FALL MEETING**

San Francisco | 15–19 December 2014

My Schedule

WEDNESDAY, DECEMBER 17, 2014

08:00 AM - 12:00 PM



OS31A New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping / Posters

Muscone Hall  
Poster Hall



OS31B New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping / Posters

Muscone Hall  
Poster Hall

01:40 PM - 03:40 PM



OS200 New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping /

Muscone Hall  
2000

04:00 PM - 06:00 PM



OS31A New Perspectives on Seafloor Morphology from High-Resolution Ocean Mapping /

Muscone Hall  
2000



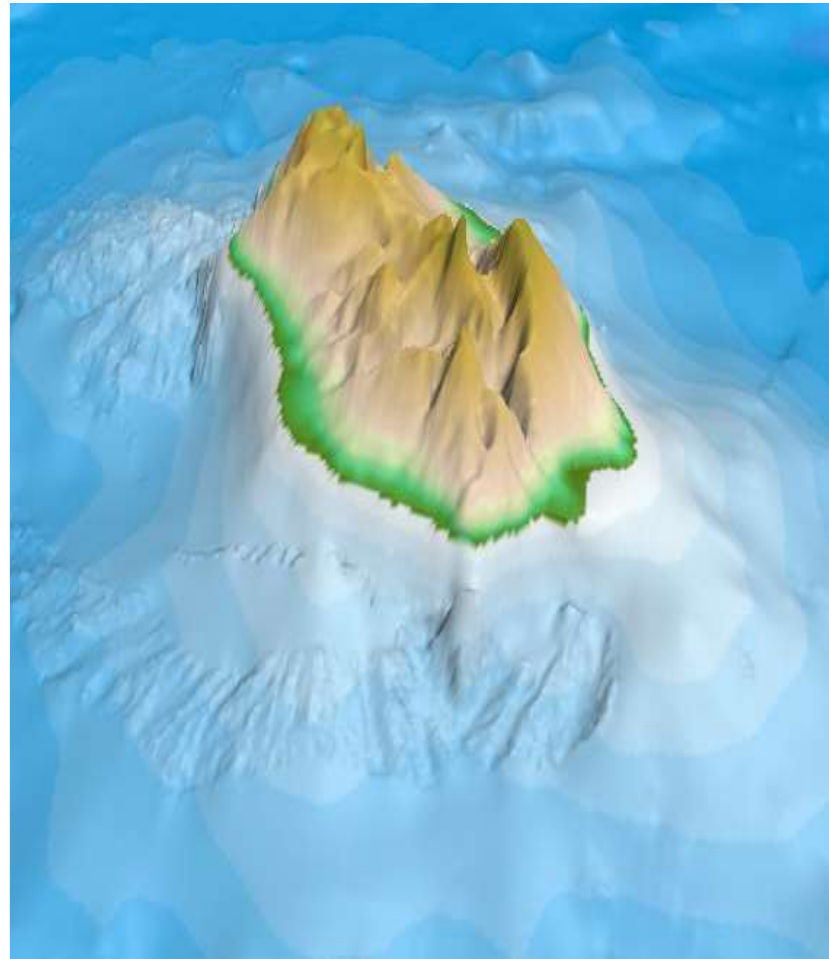
# Potential Break-out Topics

- **Regional compilations**- route to GEBCO grid, copyright issues, new projects, data sharing)
- **Updating the GEBCO grid** (Weatherall)
- **GEBCO Data Store** (Eakins)- Portal, metadata, data sharing, Cook Book chapter
- **Bathymetric gridding course** (Jakobsson)
- **SRTM15\_PLUS global 15 arc-second grid** (Sandwell, Becker)
- **Global DEM Project** (Austin)
- **Crowd sourcing** (Himschoot)
- **Metadata, attribution, multi-scale resolution**
- **GEBCO release article** (Marks, Jakobsson) if needed
- Other break-outs?

# 2014 Highlights

- Indian Ocean Bathymetric Compilation Workshop (IOBC) May, 2014
- FRAM- 2014/15 Drift of R/H SABVABAA (John Hall)
- IHO-IOC GEBCO Cook Book updated Sept. 2014
- Article in Hydro Intl (April, 2014) highlights Cook Book
- GEBCO data used in EOS cover article, displayed in news articles worldwide

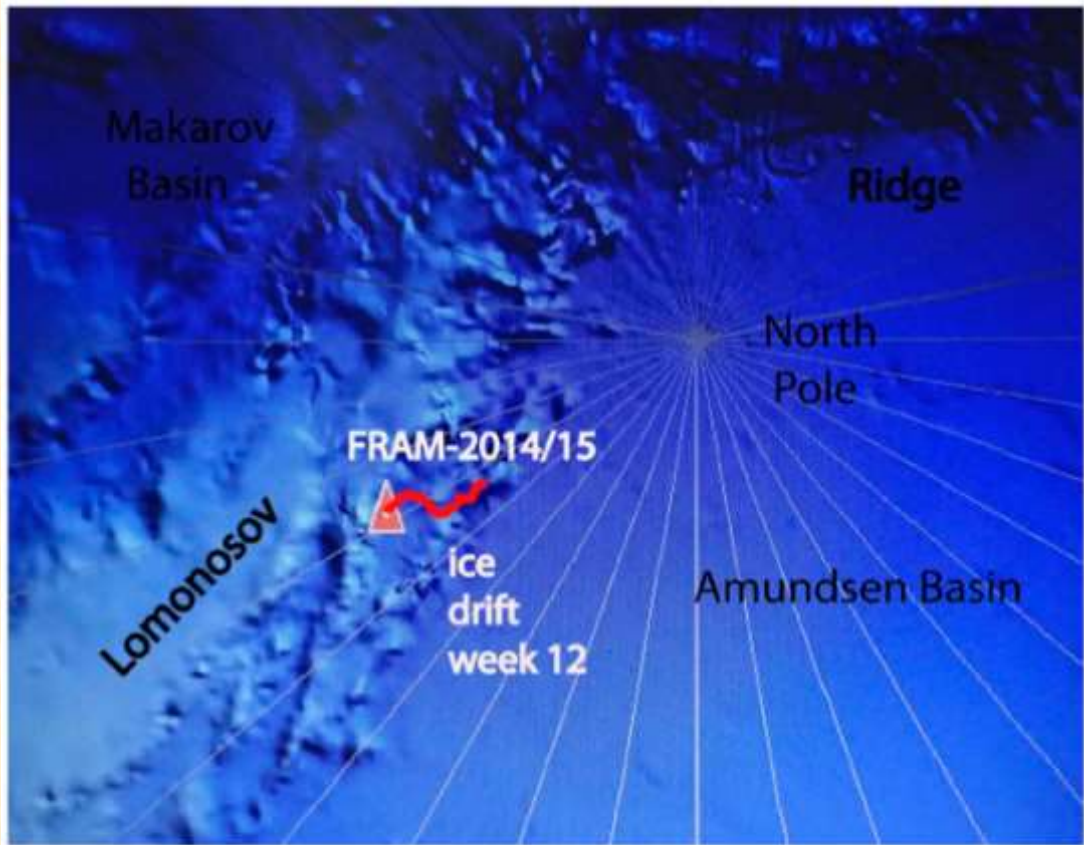
# Capacity-building workshop – Introducing the IBCSO gridding algorithm to IOBC working group



Jan Erik Arndt, AWI

Workshop- May 2014

**The twelvth week of ice drift (17 - 24 Nov. 2014)**



**14 month FRAM-2014/15 drift of R/H Sabvabaa in Arctic**

Scientific data being collected:

- Bathymetry
- Seismic reflection
- Current profiles
- Ocean temperature
- Weather
- Atmospheric data



Fig. 1 Drift track of FRAM-2014/15 over Lomonosov Ridge during week 12

John Hall, Lee Freitag

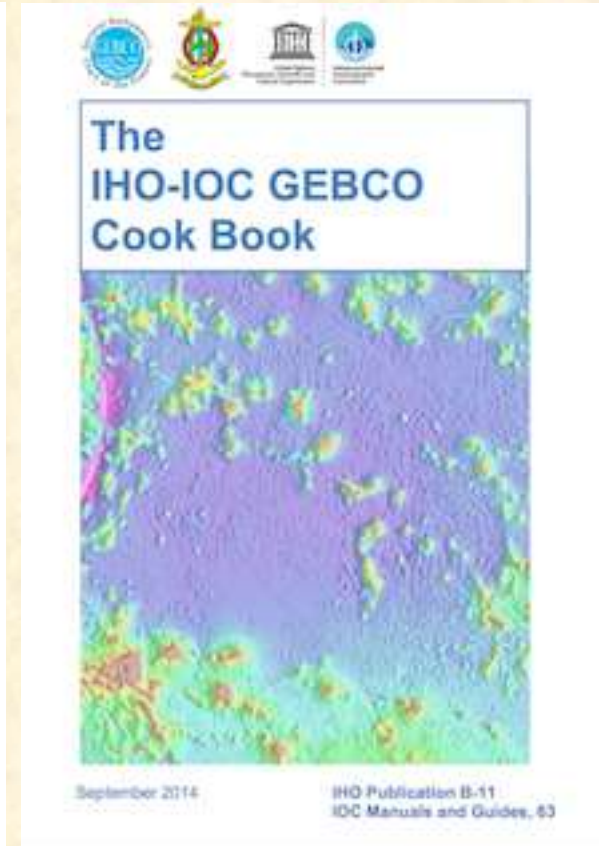




# IHO-IOC GEBCO Cook Book

At the 2009 GEBCO 25<sup>th</sup> Meeting of TSCOM, the “Cook Book Working Group” was formed to “create a manual that enables users to prepare and grid data for inclusion in GEBCO products,” resulting in:

- IHO-IOC GEBCO Cook Book published:
  - IHO Publication B-11 (April, 2012)
  - IOC Manuals and Guides, 63 (Oct. 2012)
- Available for Download: <http://www.gebco.net>
- **Updated September 2014- Chaim Keller and John Hall contributed chapter on Digital Terrain Map Editing**
- **Article in Hydro Int’l (April, 2014) highlights Cook Book**
- EOS “News Brief” announcing Cook Book was published in EOS Trans. AGU, Feb. 2013
- Used as educational resource, including:
  - UNH CCOM/JHC Ocean Mapping classes
  - Texas A&M University
  - used internationally



# Eos Feature Article

# EOS

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

VOLUME 95 NUMBER 21 27 MAY 2014

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Research Spotlight: Ozone Trends, Erosion Rate, Yellowstone, and More, p. 180

## Seafloor in the Malaysia Airlines Flight MH370 Search Area

On the morning of 8 March 2014, Malaysia Airlines flight MH370, from Kuala Lumpur to Beijing, lost contact with air traffic control shortly after takeoff and vanished. While the world waited for any sign of the missing aircraft and the 238 people on board, authorities and scientists began to investigate what little information was known about the plane's actual movements.

As days and weeks passed, the search began to focus on the Indian Ocean to the west of Australia—far from the flight's intended path. Clues to how the plane got so far off course may be in the plane's "black boxes"—its flight data and cockpit voice recorders. Finding the recorders is therefore a top priority.

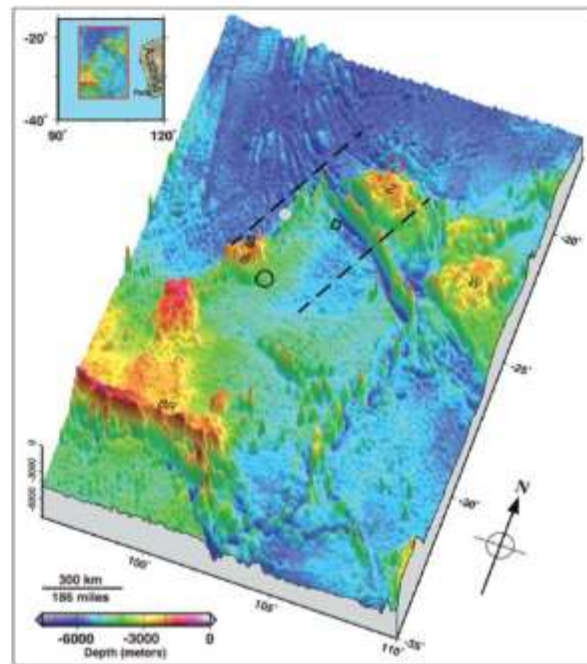
Little is known about the seafloor from ship-borne echo sounder measurements in the region where flight MH370 is believed to have crashed. Available depth measurements cover only 5% of the 2000 by 1400 kilometer area in Figure 1 (a high-resolution copy of this figure may be found in the additional supporting information in the online version of this article), and only a very few of them were acquired with modern acoustic and navigational systems. This lack of data makes the search for MH370 all the more difficult. It also highlights how most seafloor features are very poorly resolved. However, satellite altimeter measurements provide global bathymetry estimates at a

aircraft and the satellite while Doppler shifts in the handshake allowed a rough estimate of the aircraft's velocity away from the satellite.

This analysis, completed about 30 days after the disappearance, was combined with estimates of when the plane might have run out of fuel. Together they suggested that the aircraft might be anywhere in a large area of the Indian Ocean west of Australia.

MH370's black boxes were equipped with "pingers" programmed to emit acoustic signals if the boxes fell into the sea. The expected battery life of these pingers was approximately 1 month, so there were only a few days of expected pings left when it was reported that the Chinese vessel *Hakun OI* had detected pings on 4 and 5 April in the water above the east flank of the Batavia Plateau (see black circle in Figure 1). Over the next 3 days the Australian vessel *Ocean Shield* reported three other contacts, one contact apparently hearing pings emitted by two distinct devices, in an area above the north flank of the Zenith Plateau (see red circle in Figure 1).

The Batavia and Zenith contact locations are approximately 600 kilometers apart, and it seems unlikely that pingers at the end of their battery life could be heard over such distances, yet sound propagation in the ocean is quite complex. Nonetheless, Chinese and Australian authorities seemed confident that the carrier frequency, duration,



- GEBCO data used in:
- Eos Feature Article on seafloor in the MH370 search area (Smith and Marks, Eos, 27 May 2014)
- Science Magazine News article figure ("Lost at Sea," Science, 30 May 2014)



# GEBCO data displayed in news articles



27 May 2014 Last updated at 10:10 ET

**Jonathan Amos**

Science correspondent

More from Jonathan Follow Jonathan on Twitter

## MH370 spur to 'better ocean mapping'

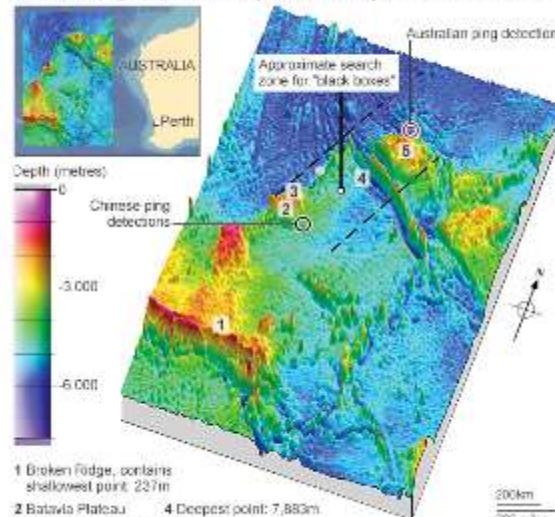
COMMENT (5)

Scientists have welcomed the decision to make all ocean depth data (bathymetry) available in the search for missing Malaysia

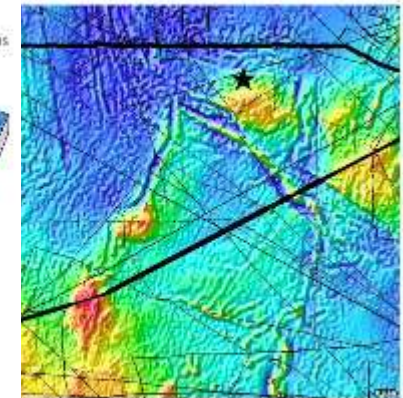


# SCIENTIFIC AMERICAN™

Seafloor topography in the Malaysia Airlines flight MH370 search area



Malaysia Airlines MH370: Searching in an ocean of uncertainty



...has frustrated once again just how poor are...  
What they say has been below the area of Malaysia Deep area challenge

## CORRIERE DELLA SERA / SCIENZE

## SPIEGEL ONLINE WISSENSCHAFT



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# news.com.au

# WIRED GEAR SCIENCE

# SCIENCE WORLD REPORT

# MaritimeSecurity.Asia

Asia's Maritime Security in brief



# 2014 TSCOM/SCRUM Meeting

## Dec. 11-13, 2014



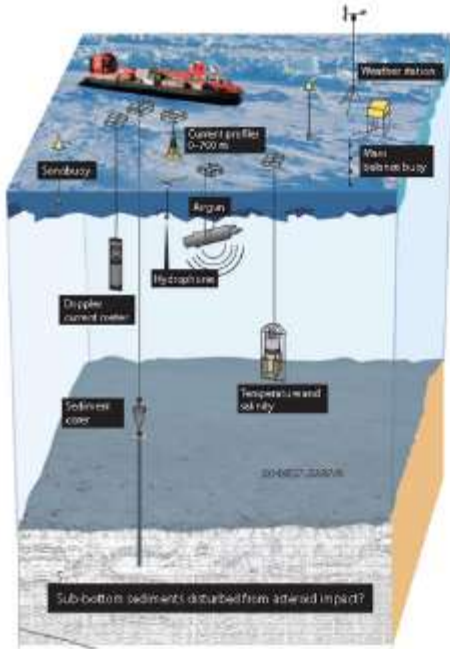
- Google Headquarters, Mountain View, CA
- Host is Jenifer Austin, Manager of Google Ocean Program
- **We thank Jenifer and Google Inc. for hosting this meeting**

# Echo Sounding Buoys

Polar bear proof covers protect the fragile antennas of the GPS and Iridium systems.

**Autonomous Drifting Echo Sounding Buoys for use in 14 month FRAM-2014/15 drift of the R/H SABVABAA**

Arctic Drift Station FRAM-2014/15



The first (ever) production run of SSPARR (Seafloor Sounding in Polar and Remote Regions) is in progress at WHOI under the direction of Engr. Lee Freitag.

Five buoys are being built for employment at distances of tens of kilometers from the FRAM drift station over the crestal regions of the Alpha Ridge north of Ellesmere Island. They have 10 kHz echo-sounders and will send their depth readings via the Iridium satellite network.



John Hall

Buoys being prepared for FRAM drift

# GEBCO\_2014 Release Paper

## Challenges:

- AGU discourages “group authorship” and requires significant contributions by listed authors
- Would be good to submit prior to Dec. 31, 2014, date through which publication fees are waived
- Most of GEBCO\_2014 update is from recent IBCAO, IBCSO, Baltic Sea, and EMODnet versions
- Science in article is section on hypsometry

## Current sections:

Introduction

Methods

Regional Seafloor Mapping Contributions

Altimetric Bathymetry

Bathymetric Soundings

Land Topography

Source Identification

Gridding and Updating

Discussion

Improvements in GEBCO\_2014

Limits of Satellite Altimetry

Bathymetric Model Resolution

Hypsometry and Physiography of the World Ocean

Summary and Outlook

## Questions:

What else can be added to “Discussion?”

Is there another scientific topic to add?