

# TSCOM report to GC 2014

Preliminary report

13-15 June 2014

International Hydrographic Bureau,  
Monaco

# TSCOM Updates

- TSCOM membership
- GEBCO Data Store
- IHO-IOC GEBCO Cook Book
- GEBCO Hi-Res product
- Joint TSCOM/SCRUM 2014 Meeting
- Highlights

# TSCOM Members

## **Members**

Jenifer Austin Foulkes – 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

# TSCOM Leadership

- Karen Marks appointed Chair and Bruce Goleby appointed Vice-Chair of TSCOM at 2013 GEBCO GC Meeting
- In April 2014, Bruce Goleby resigned from GEBCO and TSCOM
- New TSCOM Vice-Chair to be elected by TSCOM members

# 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](#)

# 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

# GEBCO Data Store: Progress

## Metadata Editing Made Easy (MEME)

- Web application tool that will enable 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
- TSCOM members are providing data format and metadata guidance

# MEME Web Application

## Create Metadata and Submit Data

### Welcome to Docucomp

The home of component metadata authoring.

Filter by:

CONTENT:

UUID:

Record Set:

Component Type:

Component Sets:

Owner:

Last Updater:

List Component

### Component Tools

- [Quick Search](#)
- [People Search](#)
- [Insert New Component](#)

### Metadata Tools

- [Record Services](#)
- [Collection Services](#)
- [Collection Groups](#)
- [Metadata Editor](#)

### Help

- [How do I get an account?](#)
- [Docucomp information page](#)

Docucomp version 2.8.3



# Create Metadata Record

**Metadata Editor Record List**

Filter by

	Edit Model	Owner	Description	Date Created	Last Updated	Last Updater	Edit State
<input type="button" value="Show"/> <input type="button" value="Edit"/>	Development		-enter description-	2014-05-07 09:35:57.0	2014-05-07 10:09:18.0		DRAFT
<input type="button" value="Show"/> <input type="button" value="Edit"/>	HSMDB editor		H12370	2014-04-23 13:29:26.0	2014-05-07 09:37:34.0		DRAFT
<input type="button" value="Show"/> <input type="button" value="Edit"/>	Development		-enter description-	2014-04-25 06:40:19.0	2014-05-07 09:35:23.0		DRAFT

[NOAA](#) | [NESDIS](#) | [NGDC Home](#) | [Contacts](#) | [Data](#) | [Disclaimers](#) | [Education](#) | [News](#) | [Privacy Policy](#) | [Site Map](#)

# Enter Metadata

MetadataEditor

**Edit Metadata Editor**

Description:  State: DRAFT

### Cruise Level Metadata Entry Form

bob3 Enter the following metadata to describe this cruise and the datatypes collected

#### Cruise Overview

**Cruise ID**  
  
e.g. KA1302, HA1104Leg2

**Cruise title**  
  
e.g. HEN04-1 from Gulfport, MS to Norfolk, VA on the USNS Henson along the Northeast US Atlantic contin

**Cruise progress**

**Cruise description summary**  
  
Include locations, datatypes, people

**Cruise purpose**

#### Dates and Ports

**Departure**

**Date**  
  
YYYY-MM-DD

**Port**  
Copy name from UNOLS port list

**Mid-Stop**

**Date**  
  
YYYY-MM-DD

**Port**  
Copy name from UNOLS port list

**Arrival**

**Date**  
  
YYYY-MM-DD

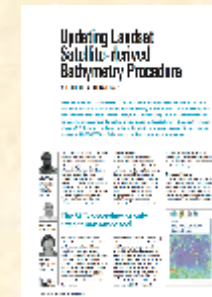
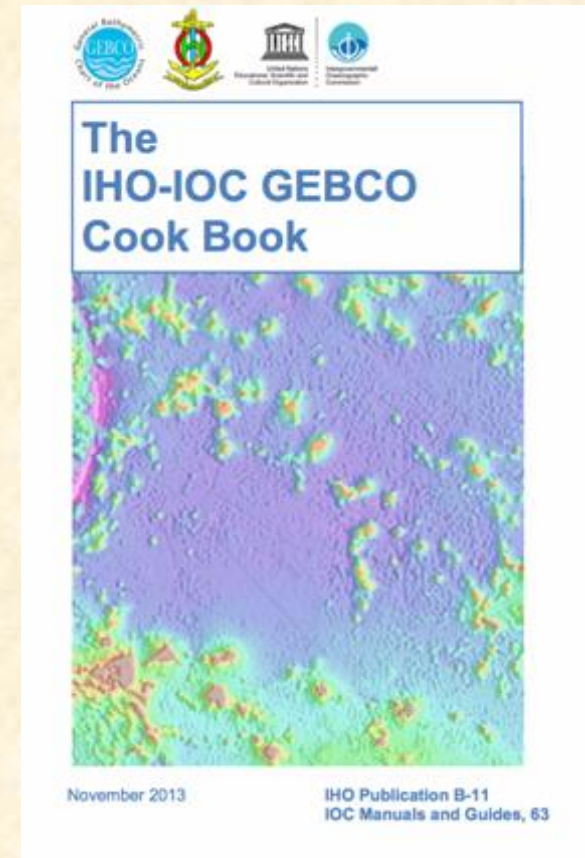
# GEBCO Data Store: On-going work

- Customize MEME for GEBCO Data Store contributions
- Develop simple step-by-step instructions for contributing data, to be incorporated into Cook Book
- Launch GEBCO Data Store online
- Submission tool and instructions to accommodate users of all experience levels
- TSCOM seeks to make contributing data simple, easy, and painless

# 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>
- EOS “News Brief” announcing Cook Book was published in EOS Trans. AGU, Feb. 2013
- Continually updated with new contributions, current version November 2013
- Article in Hydro Int’l (April, 2014) highlights Cook Book
- Used as educational resource, including:
  - UNH CCOM/JHC Ocean Mapping classes
  - Texas A&M University
  - used internationally



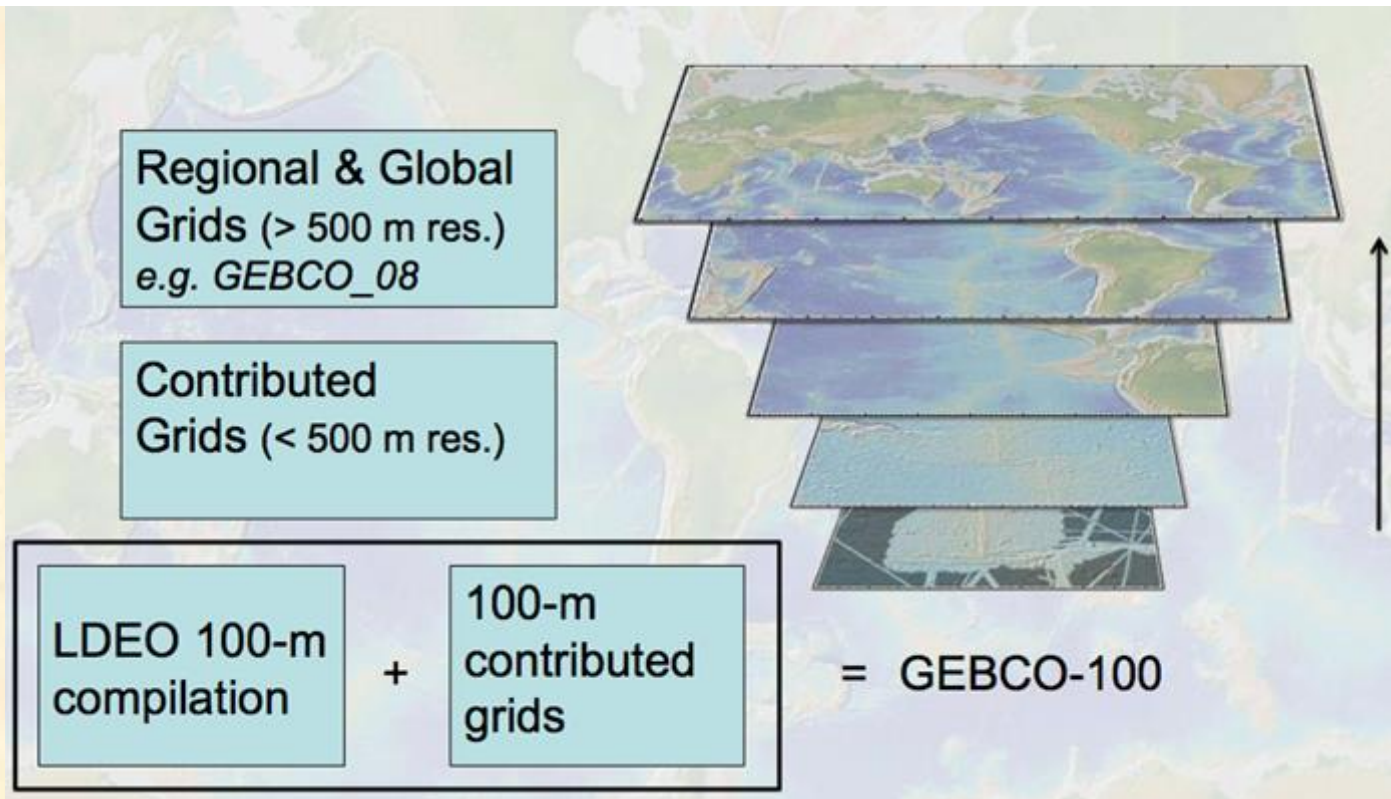
# IHO-IOC GEBCO Cook Book

## Planned Updates

- Incorporate instructions for GEBCO Data Store
- Instructions will include:
  - Simple step-by-step instructions on how to contribute data to Data Store
  - Metadata guidelines
  - Data format guidelines

# GEBCO Hi-Res Product

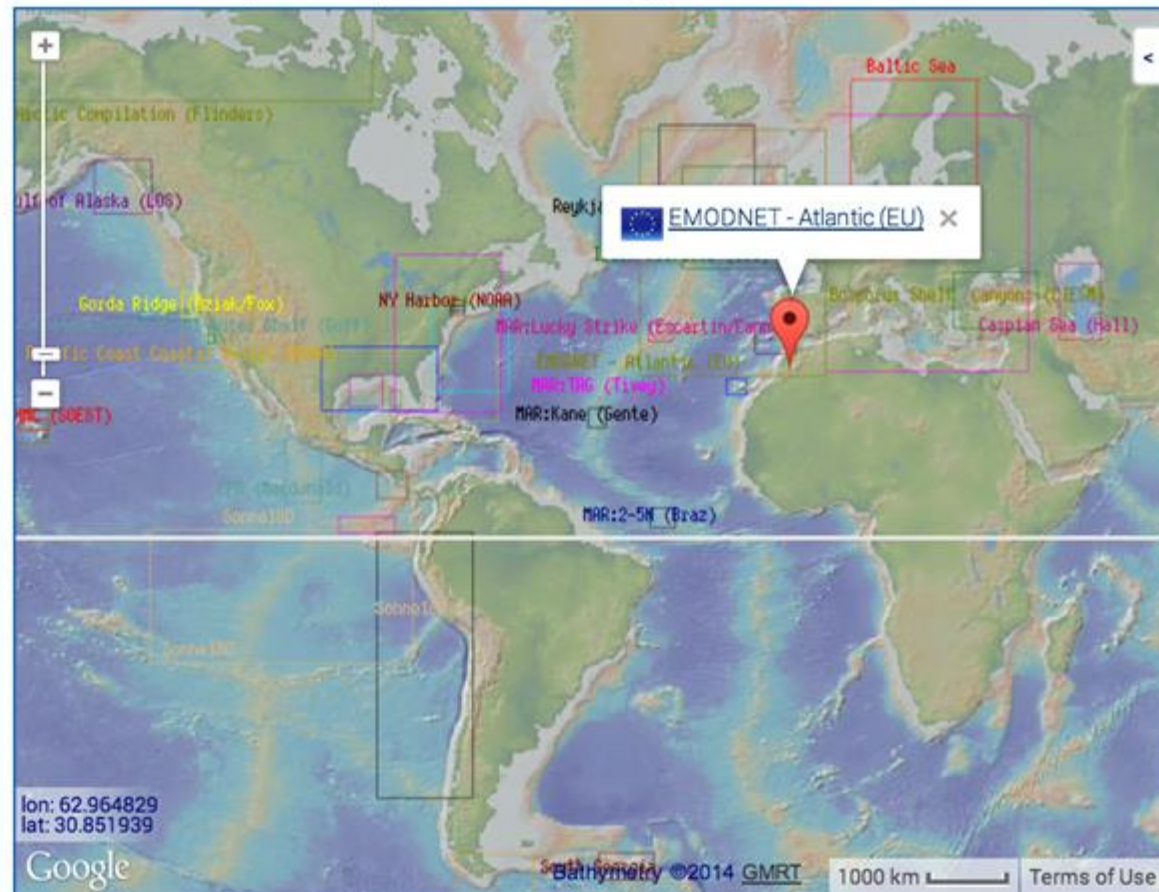
- **GEBCO Hi-Res** is a prototype effort to create a new high resolution GEBCO product
- **Global Multi-Scale Resolution Topography (GMRT)** is a synthesis of terrestrial and seafloor elevation data in image and grid form that can be viewed in various resolutions
- GEBCO\_08 grid is combined with LDEO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



Regional mapping  
ISCRUM  
Mapping projects

### GEBCO High-Res

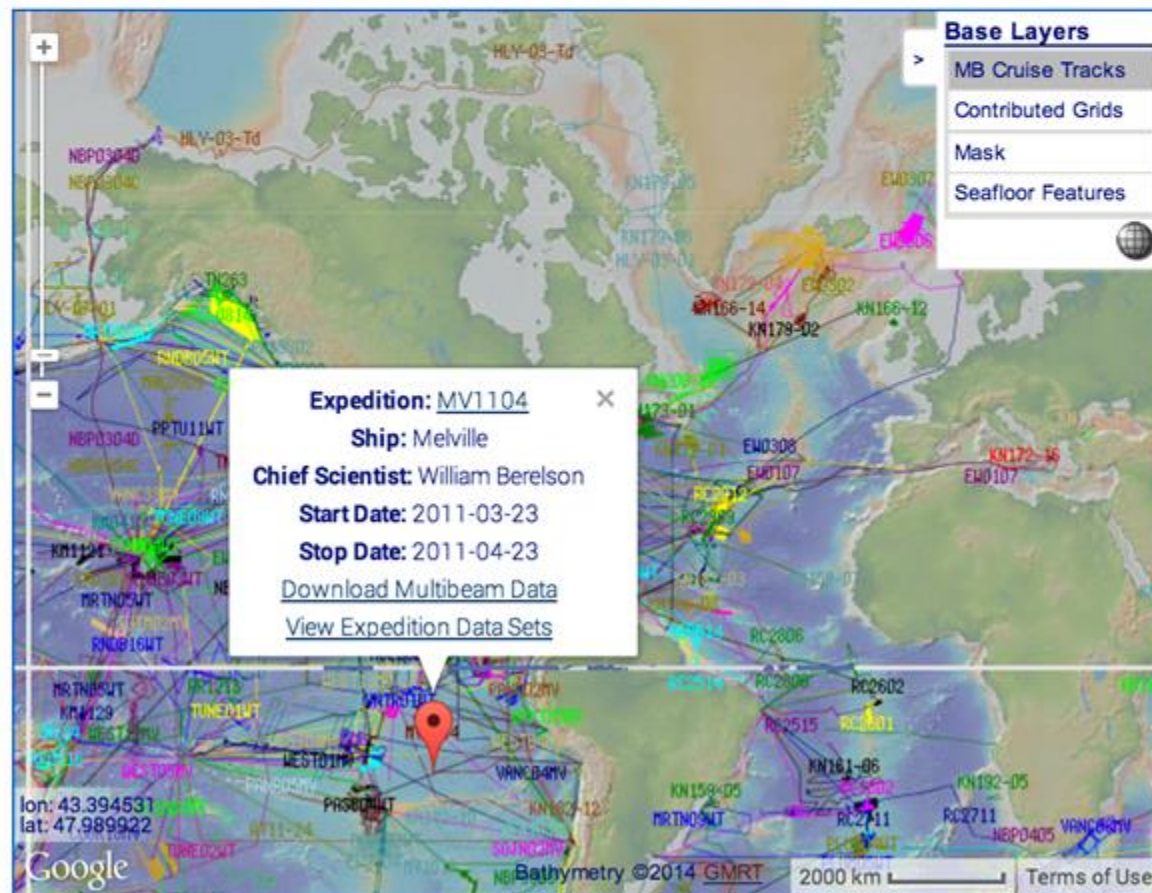
GEBCO High-Res is a prototype effort to create a new high-resolution GEBCO data product. Data currently displayed in the map include 100-m data from the LDEO GMRT synthesis as well as several contributed grids provided by international colleagues. Use the map to explore data sources and contributors.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



Regional mapping  
ISCRUM  
Mapping projects

## 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.





# GEBCO Hi-Res Product Update

- GMRT improvements:
  - *v2.6 Released May 2014*
    - Data from 48 cruises (238,989 km ship track)
    - Updated contributed grids including EMODnet, Baltic
    - Improved Attribution on web pages
  - *Under development (Spring 2014)*
    - New Web Service for accessing gridded compilation
    - Integration of attribution in web services
    - New User Interface for web app
- GEBCO Hi-Res -- *Under development (Summer 2014)*
  - Optimize workflows/tools for integrating gridded data
  - Optimize access infrastructure
    - Pre-compose gridded GMRT data compilation
    - Pre-compose Beta GEBCO-HiRes compilation
  - Optimize performance of access services
  - Solicit new prototype data contributions
  - Demo & Report at GEBCO meeting in December 2014

# 2014 TSCOM/SCRUM Meeting

## Dec. 11-13, 2014



- Google Headquarters, Mountain View, CA
- Host is Jenifer Austin Foulkes, Manager of Google Ocean Program
- Just prior to Fall 2014 Meeting
- AGU session in lieu of annual GEBCO Science Day

# Fall 2014 AGU Special Session

 **AGU FALL MEETING**

San Francisco | 15–19 December 2014

SEARCH

BROWSE BY SECTION OR

FOCUS GROUP

BROWSE BY CONVENER

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

Session ID# 1700

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-spectral scanners, to satellite altimeters. 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 estimation, 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 benthic habitats.

Index Terms:

1926 Geospatial [INFORMATICS]  
3045 Seafloor morphology, geology, and geophysics [MARINE GEOLOGY AND GEOPHYSICS]  
4562 Topographic/bathymetric interactions [OCEANOGRAPHY: PHYSICAL]

Primary Convener:

Paul A. Elmore  
[paul.elmore@nrlssc.navy.mil](mailto:paul.elmore@nrlssc.navy.mil)

Naval Research Lab  
Marine Geosciences Division  
Dennis Space Center MS, (United States)

Co-conveners:

Jenifer Foulkes  
[jfoulkes@2000gts.com](mailto:jfoulkes@2000gts.com)

Google, Inc.  
Google Ocean Program  
Mountain View CA, (United States)

Martin Jakobsson  
[martin.jakobsson@geo.uu.se](mailto:martin.jakobsson@geo.uu.se)

Stockholm University  
Department of Geological Sciences  
Stockholm, (Sweden)

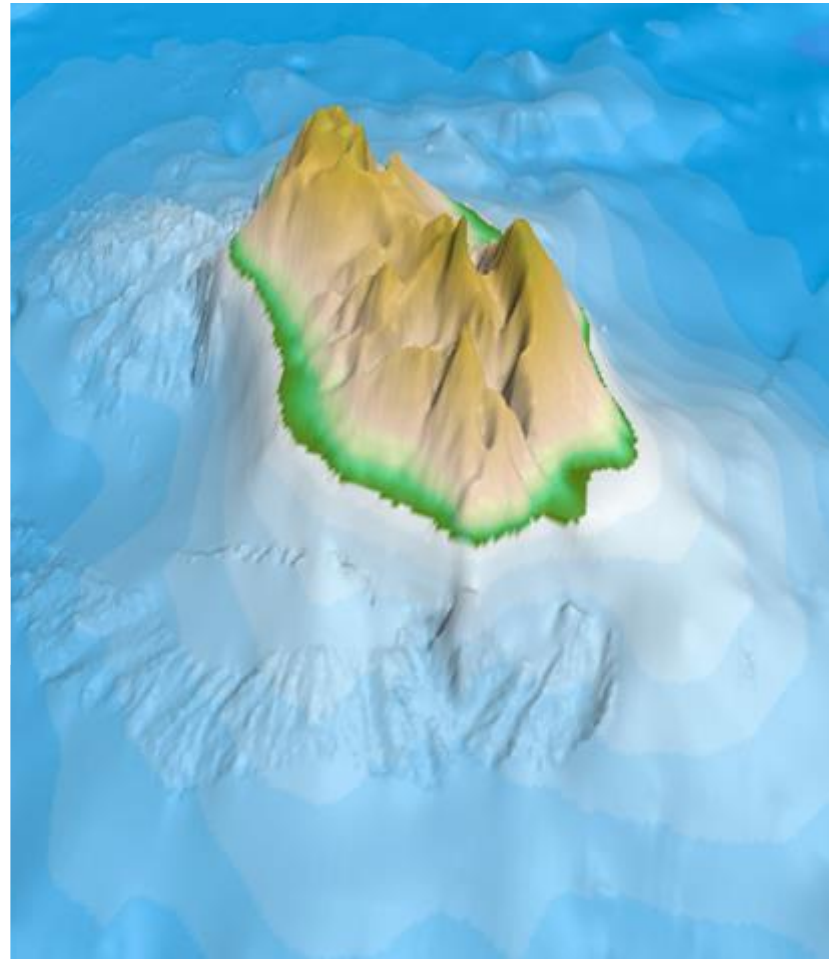
Shin Tani  
[stani@ripc.org](mailto:stani@ripc.org)

Japan Coast Guard  
Hydrographic and Oceanographic Department  
Tokyo, (Japan)

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

- Proposal for AGU accepted June 2014
- Ocean Sciences section
- Conveners
  - Paul Elmore
  - Jenifer Foulkes
  - Martin Jakobsson
  - Shin Tani
- International conveners from academia, government, and industry should draw broad interest

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



Jan Erik Arndt, AWI

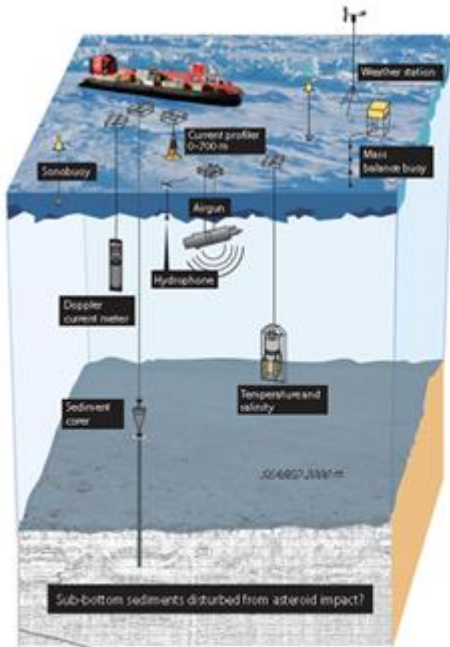
Workshop- May 2014

# 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

## Updating Landsat Satellite-derived Bathymetry Procedure

In the IHO-IOC GEBCO Cook Book

The Board/Bathymetry Chair of the Oceanographic Society (BBOC) is an international body of experts that develops bathymetric datasets and products that are made available for public use. Among these products is the International Hydrographic Organization (IHO) and the International Geographical Commission (IGC) GEBCO Cook Book that provides the international community with a set of procedures for processing and analyzing satellite-derived bathymetry data. Landsat 8 was launched in January 2013. The imagery from this new multispectral satellite is free and publicly available. This paper discusses updates in the IHO-IOC GEBCO Cook Book chapter on using Landsat imagery to derive bathymetry.



**Bruce A. Gold**  
Bathymetry  
Coordinator  
Pew Center  
for Ocean  
and Earth  
Systems  
UNC-CH

**THE IHO-IOC GEBCO COOK BOOK** provides step-by-step instructions for users that do not have a background in Hydrography or Geomatics. Information Systems (GIS) (<http://www.geomatica.com>). One of the procedures provided in the Cook Book is the Landsat satellite-derived bathymetry (SDB), as outlined in Chapter 12 (Section 6.3.1.1) (Figure 1). The SDB procedure provides a quick reconnaissance of the seafloor bathymetry for a user.

**Landsat Imagery**  
There are several commercial satellites in orbit (e.g., Terra and WorldView) that can be used for deriving bathymetry data for users with Landsat funds. Landsat imagery provides a free and publicly available resource (http://earthexplorer.usgs.gov). Early this year (2014), the fourth Landsat mission satellite was launched. Still, as the procedure is a well-established working methodology

and there is a strong potential accuracy of Landsat 8 as compared to 44m from the 30m accuracy standard for Landsat 7 imagery.

**Procedure Updates**  
A major difference between Landsat 7 and Landsat 8 bathymetry is that the cost of the satellite imagery is now available in the imagery (Figure 2). The updated procedure provides the user with a reconnaissance of the seafloor



**Sarah Pratt**  
IGC/IHO

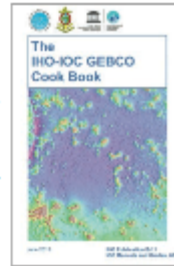
### The SDB procedure is only a reconnaissance tool



**Peter Hobbie**  
IGC/IHO

satellite imagery to identify bathymetric changes between consecutive images from different periods between coastal satellite imagery and a multi-beam. The steps in the updated SDB procedure are proposed to use a population, multivariate correlation matrix and an a priori approach to the bathymetry algorithm, and adjusting the bathymetry to the actual data.

assumed in the satellite continuously collected imagery with a swath width of 185km and an image resolution of up to 30m. The Landsat imagery is orthorectified and referenced to the WGS84 at World. The new bathymetric bathymetric level is up to 100m, provides a spectral band of a large dynamic range compared to the previous standard on Landsat 7, 30m and 110m. Mapper plus (2014) (Figure 3).



18 | APRIL 2014 | Hydro International

## Hydro International article highlights Cook Book

- Hydro International publication (Pe’eri, Tetteh, Marks, April 2014)
- Highlights Landsat satellite-derived bathymetry procedure in IHO-IOC GEBCO Cook Book
- Cook Book chapter details step-by-step instructions

Impact of Wastewater from  
Fukushima Nuclear Power Station  
On the Oceanographic Environment

The New Role of Hydrography  
in the 21st Century



In the IHO-GEBCO Cook Book

## Updating Landsat Satellite-derived Bathymetry Procedure

# GEBCO data used in search for Malaysia Airlines flight MH370



Information from Bruce Goleby

Image of an aircraft from Malaysia Airlines website

# Eos Feature Article

# EOS

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

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## 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 239 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.

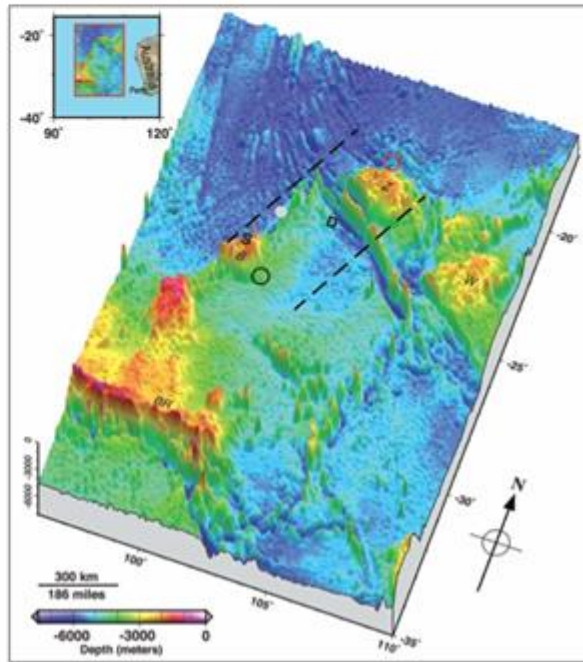
Little is known about the seafloor from ship-borne echo sounder measurements in the region where flight MH370 is believed to have crashed. Available depth measurements cover only 5% of the 2000 by 1400 kilometer area in Figure 1 (a high-resolution copy of this figure may be found in the additional supporting 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 10 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 *Haiyan 01* 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,



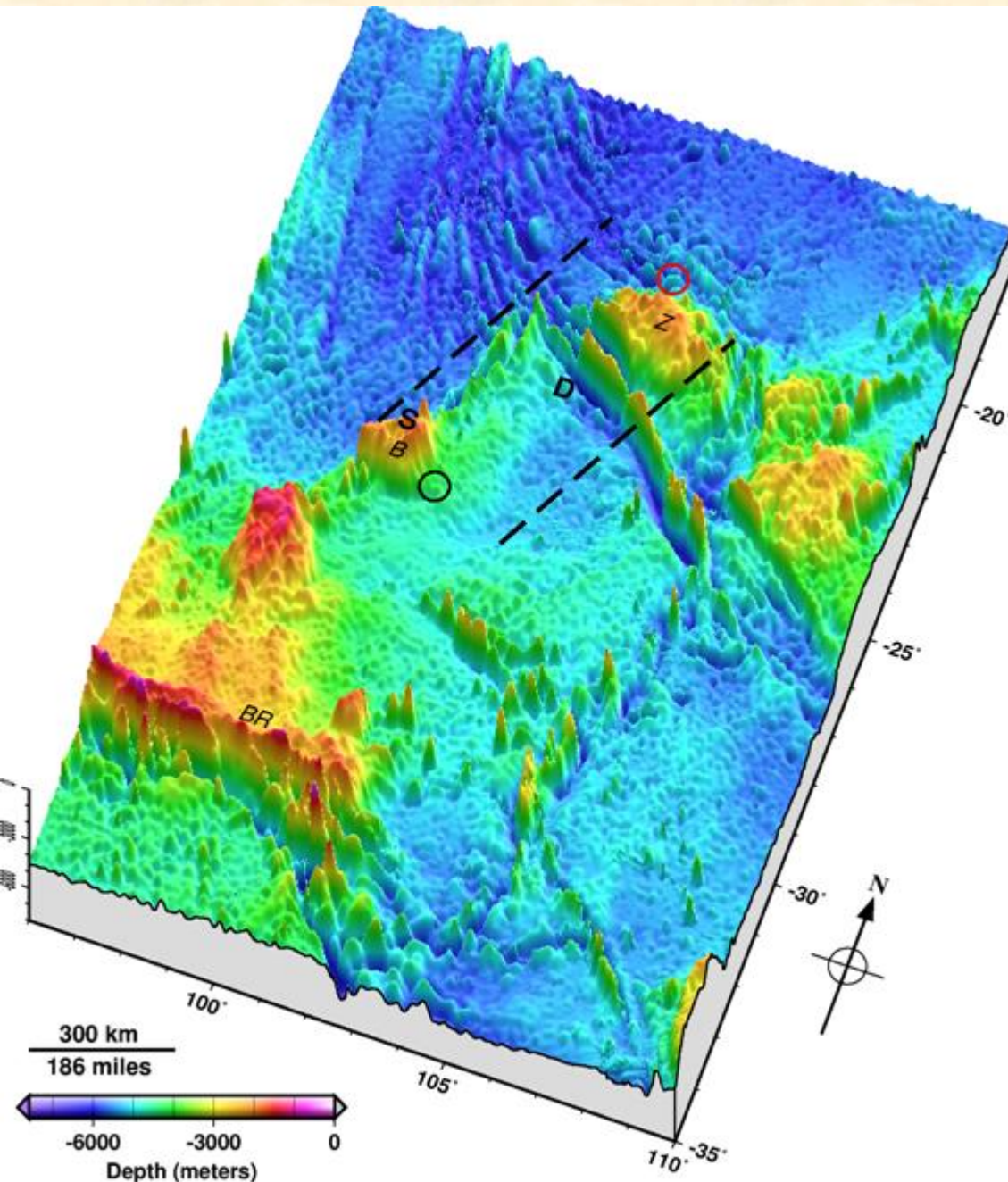
- GEBCO data used in Eos Feature Article on seafloor in the MH370 search area (Smith and Marks, Eos, 27 May 2014)

- In this area:
  - Only 5% of seafloor depths constrained by soundings
  - Remainder are depths estimated from satellite altimetry



## Science Magazine News Article

- GEBCO data used in Science Magazine News article figure (“Lost at Sea,” Science, 30 May 2014)
- Illustration shows seafloor in Malaysia Airlines flight MH370 search area



# 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'

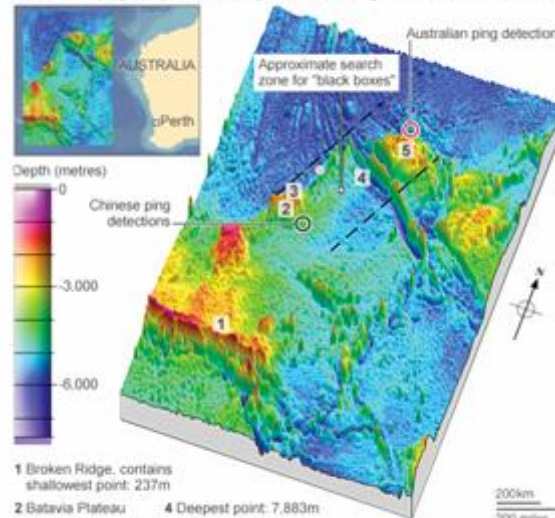
COMMENTS (5)

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



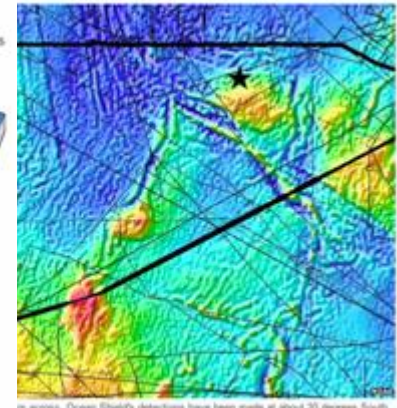
# SCIENTIFIC AMERICAN™

Seafloor topography in the Malaysia Airlines flight MH370 search area



- 1 Broken Ridge, contains shallowest point: 237m
- 2 Batavia Plateau
- 4 Deepest point: 7,883m

## Malaysia Airlines MH370: Searching in an ocean of uncertainty



It has illustrated once again just how poor are

when they say we know better the shape of Mars

MH370 mystery

Deep sea challenge

## CORRIERE DELLA SERA / SCIENZE

## SPIEGEL ONLINE WISSENSCHAFT



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GEAR SCIENCE

# SCIENCE WORLD REPORT

# MaritimeSecurity.Asia

Asia's Maritime Security in brief

# Summary

- Progress made on:
  - GEBCO Data Store
  - Cook Book
  - High-resolution grids
- Joint TSCOM/SCRUM Meeting planned for Dec. 11-13, 2014, venue Google, Inc. Headquarters
- Fall 2014 AGU special session in lieu of GEBCO Science Day
- Cook Book highlighted in published article
- GEBCO grid highlighted in publications and in news articles worldwide