



# The IHO Data Centre for Digital Bathymetry

## *An Overview*

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IHO CSBWG Chair

NOAA's National Centers for Environmental Information

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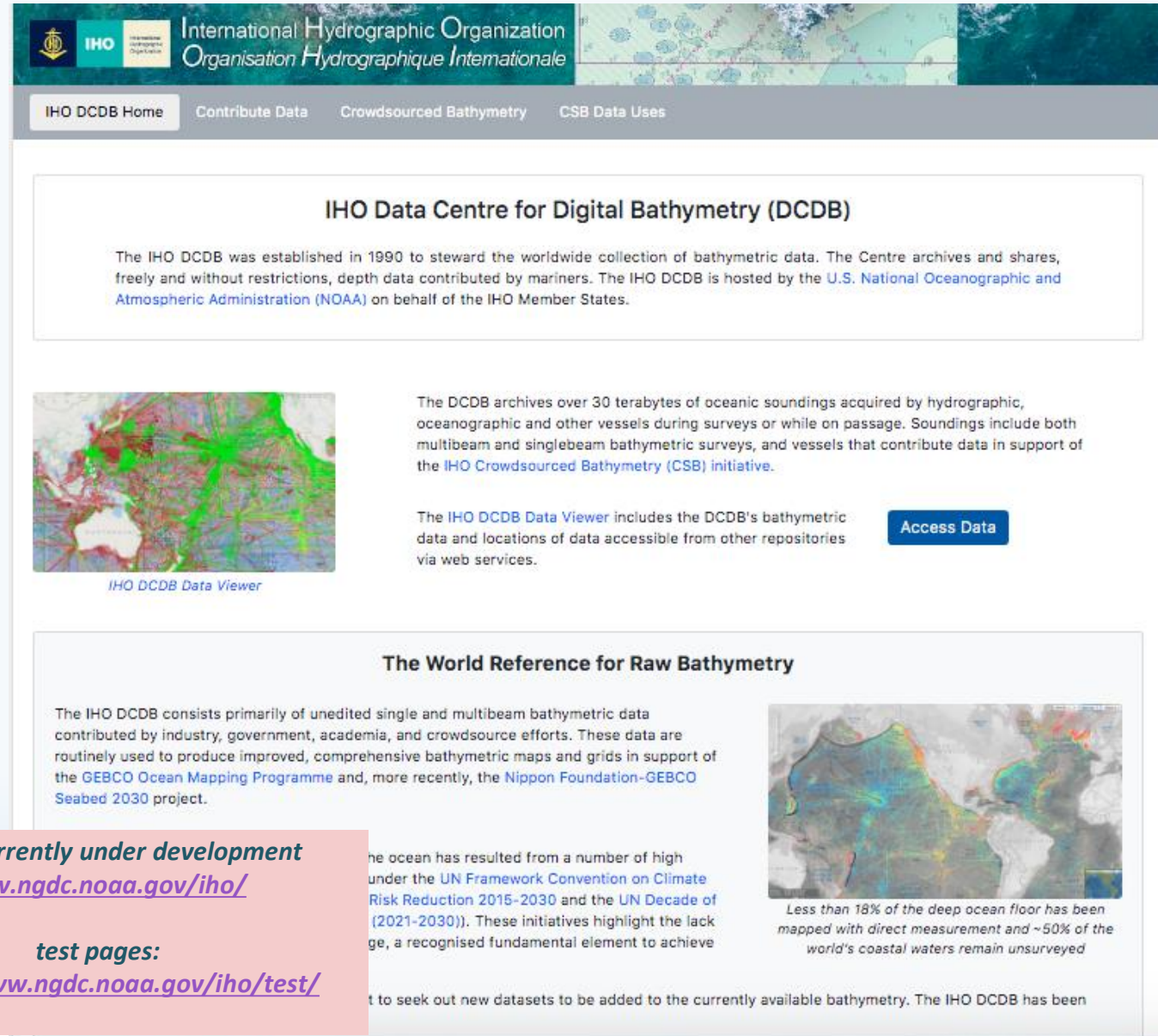


# IHO Data Centre for Digital Bathymetry (DCDB)

The **IHO DCDB** is the recognized IHO repository for all ocean bathymetric data collected by hydrographic, oceanographic and other vessels.

**NOAA's NCEI (formally NGDC) has hosted the DCDB since 1990.**

Data are sent to the IHO DCDB, where we provide long term archive and data management.



The screenshot shows the IHO DCDB website homepage. At the top, there is a navigation bar with the IHO logo and the text "International Hydrographic Organization / Organisation Hydrographique Internationale". Below the navigation bar, there are several menu items: "IHO DCDB Home", "Contribute Data", "Crowdsourced Bathymetry", and "CSB Data Uses". The main content area features a large heading "IHO Data Centre for Digital Bathymetry (DCDB)" followed by a paragraph explaining its mission: "The IHO DCDB was established in 1990 to steward the worldwide collection of bathymetric data. The Centre archives and shares, freely and without restrictions, depth data contributed by mariners. The IHO DCDB is hosted by the U.S. National Oceanographic and Atmospheric Administration (NOAA) on behalf of the IHO Member States." Below this, there is a section titled "IHO DCDB Data Viewer" with a small map thumbnail and a description: "The DCDB archives over 30 terabytes of oceanic soundings acquired by hydrographic, oceanographic and other vessels during surveys or while on passage. Soundings include both multibeam and singlebeam bathymetric surveys, and vessels that contribute data in support of the IHO Crowdsourced Bathymetry (CSB) initiative." To the right of this section is a blue button labeled "Access Data". Further down, there is a section titled "The World Reference for Raw Bathymetry" with a paragraph: "The IHO DCDB consists primarily of unedited single and multibeam bathymetric data contributed by industry, government, academia, and crowdsourced efforts. These data are routinely used to produce improved, comprehensive bathymetric maps and grids in support of the GEBCO Ocean Mapping Programme and, more recently, the Nippon Foundation-GEBCO Seabed 2030 project." To the right of this section is another map thumbnail with a caption: "Less than 18% of the deep ocean floor has been mapped with direct measurement and ~50% of the world's coastal waters remain unsurveyed". At the bottom of the page, there is a pink box containing the text: "Pages currently under development [www.ngdc.noaa.gov/iho/](http://www.ngdc.noaa.gov/iho/) test pages: <https://www.ngdc.noaa.gov/iho/test/>".





# Accessing data from the DCDB

The DCDB utilizes NCEI's standard web services for promoting data access - both the *discovery and delivery of data and metadata*.

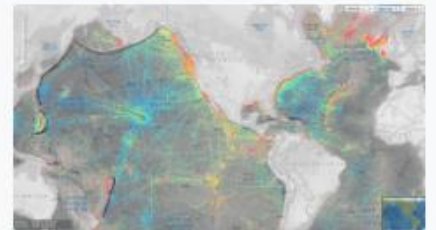
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The IHO DCDB Data Viewer includes the DCDB's bathymetric data and locations of data accessible from other repositories via web services.



## The World Reference for Raw Bathymetry

...ity of unedited single and multibeam bathymetric data ment, academia, and crowdsourced efforts. These data are roved, comprehensive bathymetric maps and grids in support of ogramme and, more recently, the Nippon Foundation-GEBCO



Less than 18% of the deep ocean floor has been mapped with direct measurement and ~50% of the world's coastal waters remain unsurveyed

...bal focus on the ocean has resulted from a number of high is Agreement under the UN Framework Convention on Climate k for Disaster Risk Reduction 2015-2030 and the UN Decade of evelopment (2021-2030)). These initiatives highlight the lack

of comprehensive global bathymetric coverage, a recognised fundamental element to achieve the goals of each.

Seabed 2030 has created a global movement to seek out new datasets to be added to the currently available bathymetry. The IHO DCDB has been identified as the preferred data archive.





# Contributing data to the DCDB

IHO Member States and other organizations can contribute bathymetric data and metadata:

- **Raw sonar data:** all original manufacturer's formats
- **Processed data:** BAG, NetCDF, tiff, xyz, sd, asc, etc.
- **Metadata:** XML or text

We accept bathymetric data via FTP, e-mail, or mail (hard drive, DVD).



## How to Contribute Data to the IHO DCDB

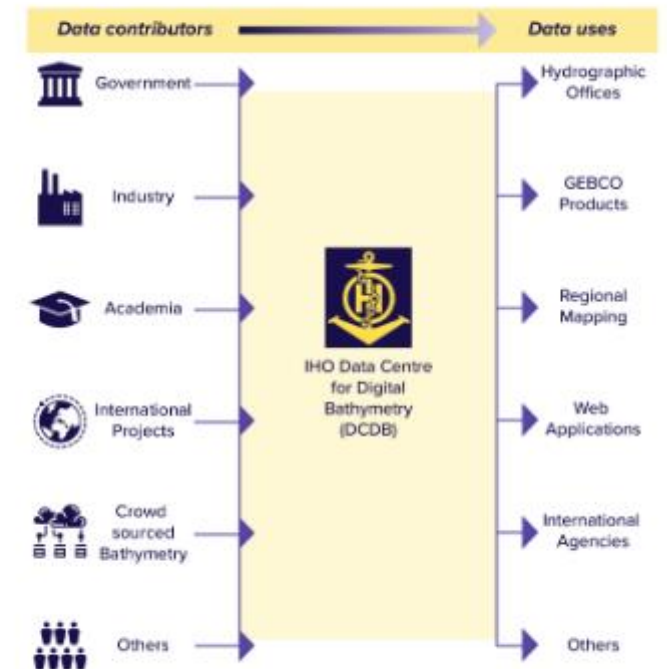
Contact [bathydata@iho.int](mailto:bathydata@iho.int) for more information on contributing data or sharing web services to the IHO DCDB. Refer to [Submitting Marine Geophysical Data to the IHO DCDB](#) for how to package and submit data.

Governments, organizations, academia, industry and individuals are encouraged to contribute data to the IHO DCDB. Bathymetric data and metadata can be submitted via File Transfer Protocol (FTP), email, or mail (hard drive) in the formats listed below. Other formats will be considered on a case-by-case basis.

- **Raw sonar data:** MGD77T or the original manufacturer's format
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- **Metadata:** XML or text

Learn more about contributing [crowdsourced bathymetry](#).

IHO Member States are invited ([IHO Circular Letter 36/2006](#)) to provide low density shallow water bathymetry for their coastal areas. A tool, developed and distributed with [CL 36/2006](#), and available upon request, will facilitate the extraction of soundings and contours from Electronic Navigational Charts (ENC) cells. Only data from ENCs in navigational purpose bands 2 and 3 are requested.



# Contributing data to the DCDB



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# Contributing data to the DCDB

Data collection/ management guidelines and metadata templates to encourage data collectors into becoming data providers.

- Metadata fields spreadsheet
- Requested directory structure

**2. Single File Structure:**  
The data may be delivered in one archived file (e.g., tar or zip) or in a well-defined directory structure. Please include an MD5 checksum with the delivery so NCEI can verify the integrity of the files and the completeness of the data transfer. For questions regarding MD5 checksums, contact [mb.info@noaa.gov](mailto:mb.info@noaa.gov).

A preferred data structure would be the following:

```
<ship name>
  <cruise ID>
    cruise/
      o metadata – cruise level
      o cruise report/documentation
    multibeam/
      o version1/
        ▪ data/ – include raw (as collected) data files
        ▪ metadata/ – dataset level
        ▪ ancillary/ – include SSP, nav, tracklines, etc.
      o version2/
        ▪ data/ – include processed data files
        ▪ metadata/ – metadata to include processing steps
        ▪ ancillary/ – include SSP, nav, tracklines, etc.
        ▪ products/ – include grids, images or other derived products
    subbottom/
      o data/ – include all segy files
      o metadata/ – dataset level
    wcsd/
      o data/ – include all raw files
      o metadata/ – dataset level
```

**Data Submission:**  
Email [mb.info@noaa.gov](mailto:mb.info@noaa.gov) to alert the multibeam data manager of incoming data (multibeam, subbottom, wcsd), set up your data submission, or ask any questions.

Data can be delivered to NCEI via (1) shipping external hard drives, (2) uploading to NCEI's FTP server, or (3) data copy using [rsync](#) through a secure shell login ([linux](#)).

1. External hard drives containing a data submission can be shipped to the following address  
Evan Robertson  
NOAA NCEI  
325 Broadway E/NE42  
Boulder, CO 80305
2. NCEI maintains a number of public FTP servers. All the FTP servers allow anonymous ftp



# Contributing data to the DCDB

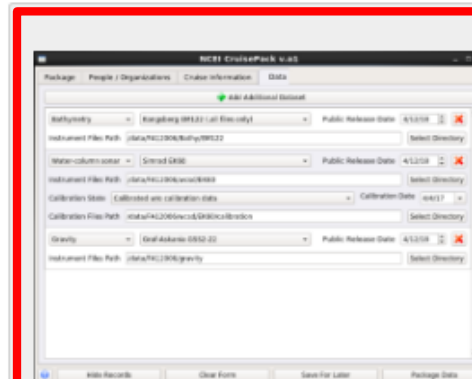
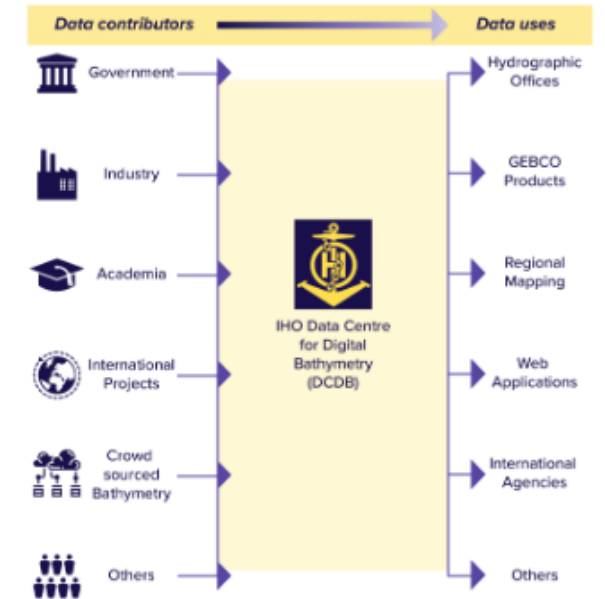
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## CruisePack Software

NOAA NCEI is developing and testing *CruisePack*, a data packaging and metadata gathering software tool that simplifies how a data provider collects and submits cruise-based data. *CruisePack* features a simple user interface to control packager operation and facilitate metadata entry. Once the user completes metadata entry, data packaging is automatic. *CruisePack* copies the data, generates machine-parseable JSON metadata records and creates a checksum manifest file; all contained in a structured data package conforming to the BagIt specification.

*CruisePack* aims to meet a growing community need to submit geophysical data efficiently and in a consistent format. This software is available upon request ([mb.info@noaa.gov](mailto:mb.info@noaa.gov)).





# Contributing data to the DCDB

## Cruise Data Packager (CruisePack)

### One tool to pack it all...

- Stand-alone packager for cruise-based data.
- Additional data types and instruments can be added with little or no modifications to code.
- Simple user interface with pulldown menus and controlled vocabularies
- Creates consistent BagIt format data packages complete with md5 checksum manifest files.
- Generates cruise-level and series level metadata files

NCEI CruisePack v.a1

Package | People / Organizations | Cruise Information | Data

+ Add Additional Dataset

Bathymetry | Kongsberg EM122 (.all files only) | Public Release Date 4/12/18

Instrument Files Path /data/FA12006/Bathy/EM122 | Select Directory

Water-column sonar | Simrad EK60 | Public Release Date 4/12/18

Instrument Files Path /data/FA12006/wcsd/EK60 | Select Directory

Calibration State Calibrated w/o calibration data | Calibration Date 4/4/17

Calibration Files Path /data/FA12006/wcsd/EK60/calibration | Select Directory

Gravity | Graf-Askania GSS2-22 | Public Release Date 4/12/18

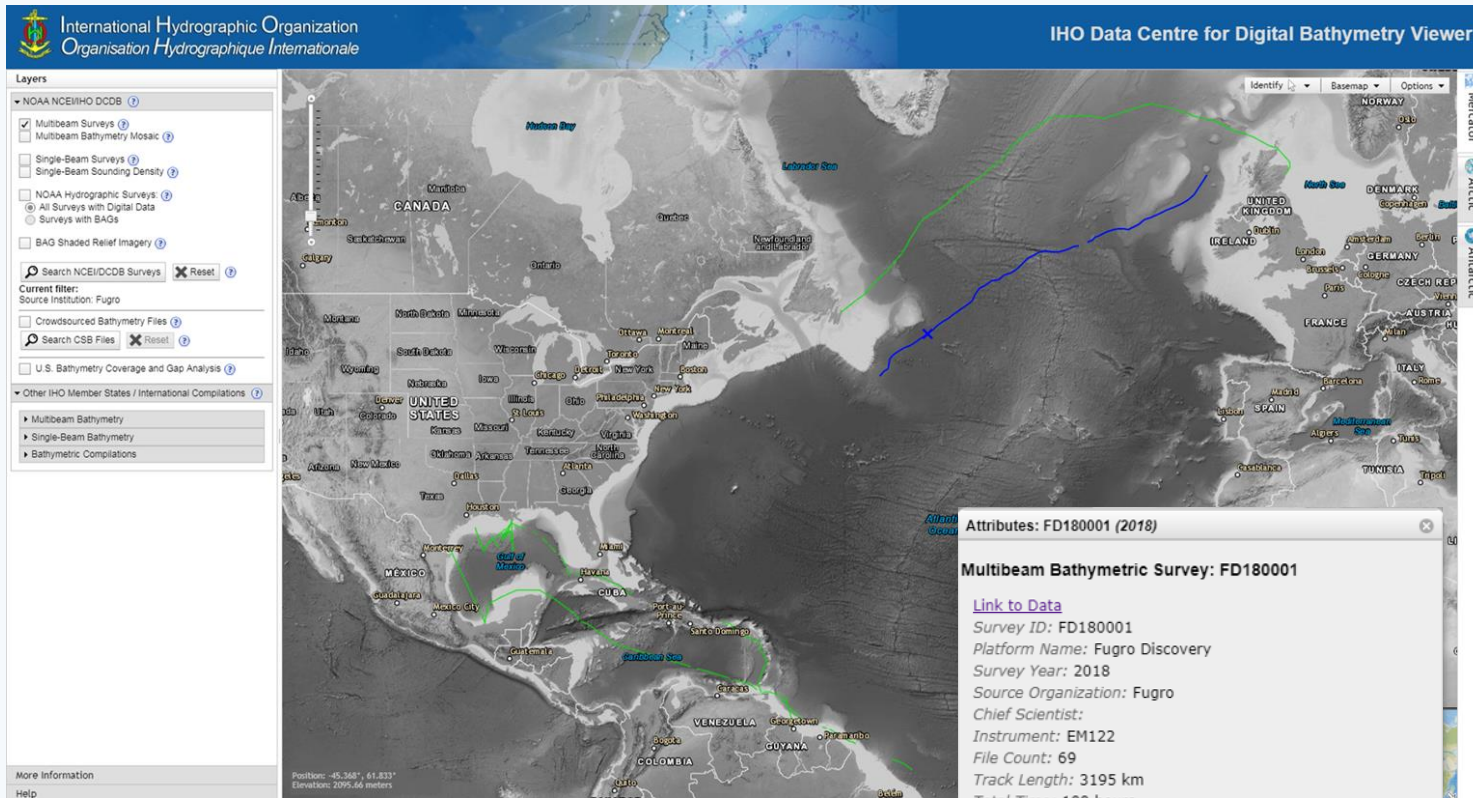
Instrument Files Path /data/FA12006/gravity | Select Directory

Hide Records | Clear Form | Save For Later | Package Data





# Industry contributing data - *Fugro*



NCEI/DCDB worked with Fugro to identify metadata gaps and offer suggestions for improved data packaging to allow Fugro to provide a more complete product.

This has allowed Fugro to quickly identify a workflow and delivery method that promotes consistency across the fleet at almost zero cost to them.

*Multibeam: 19 surveys, ~269 Gb*  
*Water column sonar: 12 surveys, 457 Gb*



# Contributing data - *IHO Crowdsourced Bathymetry Initiative*

An IHO-led collaborative project to better enable mariners and professionally manned vessels to collect “crowdsourced bathymetry”

**CSB is the collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations.**

A Working Group was formed and tasked to develop an IHO publication (*B-12 IHO Guidance on Crowdsourced Bathymetry*) that states the IHO’s policy towards, and best practices for, the collection and contribution of CSB.







# B-12 Edition 2.0.2

[https://www.iho.int/iho\\_pubs/bathy/B\\_12\\_Ed2.0.2\\_2019.pdf](https://www.iho.int/iho_pubs/bathy/B_12_Ed2.0.2_2019.pdf)



International Hydrographic Organization  
*Organisation Hydrographique Internationale*

B-12 Edition 2.0.2

## Guidance on Crowdsourced Bathymetry

IHO

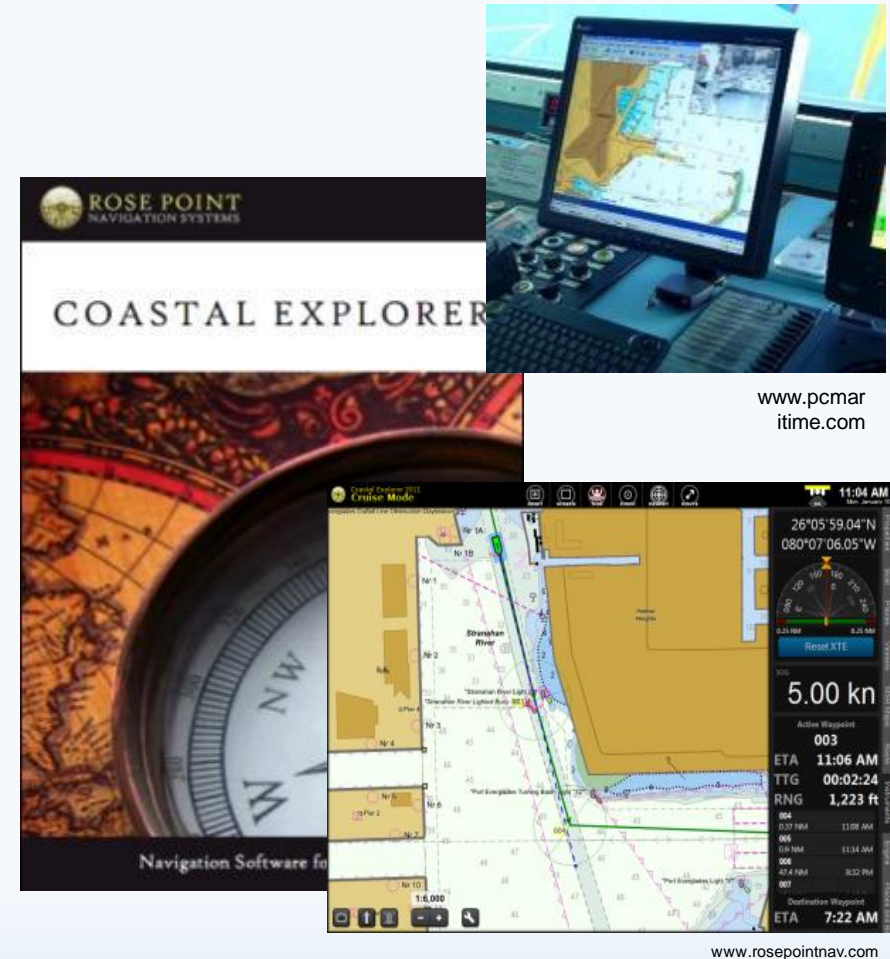


International  
Hydrographic  
Organization

Published by the  
International Hydrographic Organization  
4b quai Antoine 1<sup>er</sup>  
Principauté de Monaco  
Tel: (377) 93.10.81.00  
Fax: (377) 93.10.81.40  
info@iho.int  
www.iho.int

# IHO DCDB Pilot Project

- IHO DCDB and NOAA teamed up with Rose Point Navigation Systems
- Using their navigational system software, mariners can enable a modified electronic charting system log file to *record position, depth and time.*
- Mariners can capture metadata about vessel and equipment.
- Whenever the mariner updates the software or chart catalog, the data is sent to Rosepoint who then transmits the data to the DCDB via HTTPS post.





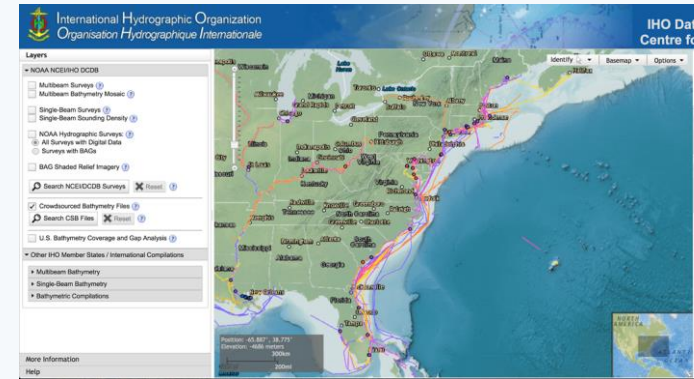
# IHO DCDB CSB Pipeline

**Data discovery and access via our map viewer.**  
**Data delivered as a collection of files.**

```
{  
  "platform":  
  {  
    "uniqueID": "ROSEP-e8c669f8-df38-16e5-b86d-9a79606e9478",  
    "type": "Ship",  
    "name": "SS Dinghy",  
    "length": 65,  
    "lengthUnitOfMeasure": "meters",  
    "IDType": "IMO",  
    "IDNumber": "1008140"  
  }  
}
```

**CSB data log file (with  
JSON metadata string)**

```
lat,lon,depth,time  
47.666520,-122.098525,21.49,20161017T234638Z  
47.666518,-122.098525,11.98,20161017T234739Z  
47.666517,-122.098527,14.63,20161017T234839Z  
47.666515,-122.098527,17.16,20161017T234935Z  
47.666490,-122.098472,19.72,20161017T235044Z  
47.666505,-122.098522,20.18,20161017T235141Z  
47.666477,-122.098507,20.42,20161017T235241Z  
47.666512,-122.098432,20.63,20161017T235342Z  
47.666497,-122.098417,20.33,20161017T235443Z  
47.666512,-122.098470,20.33,20161017T235548Z  
47.666507,-122.098490,20.57,20161017T235644Z  
47.666533,-122.098453,20.33,20161017T235832Z  
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47.666585,-122.098460,20.21,20161018T000236Z  
47.666417,-122.098443,18.32,20161018T000337Z  
47.666417,-122.098443,15.27,20161018T000438Z  
47.666433,-122.098473,12.68,20161018T000538Z  
47.666490,-122.098562,10.06,20161018T000638Z  
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47.666487,-122.098527,18.32,20161018T000939Z  
47.666398,-122.098182,20.12,20161018T001038Z  
47.666393,-122.098185,20.30,20161018T001045Z  
47.666388,-122.098182,20.42,20161018T001046Z  
47.666375,-122.098180,20.70,20161018T001047Z
```



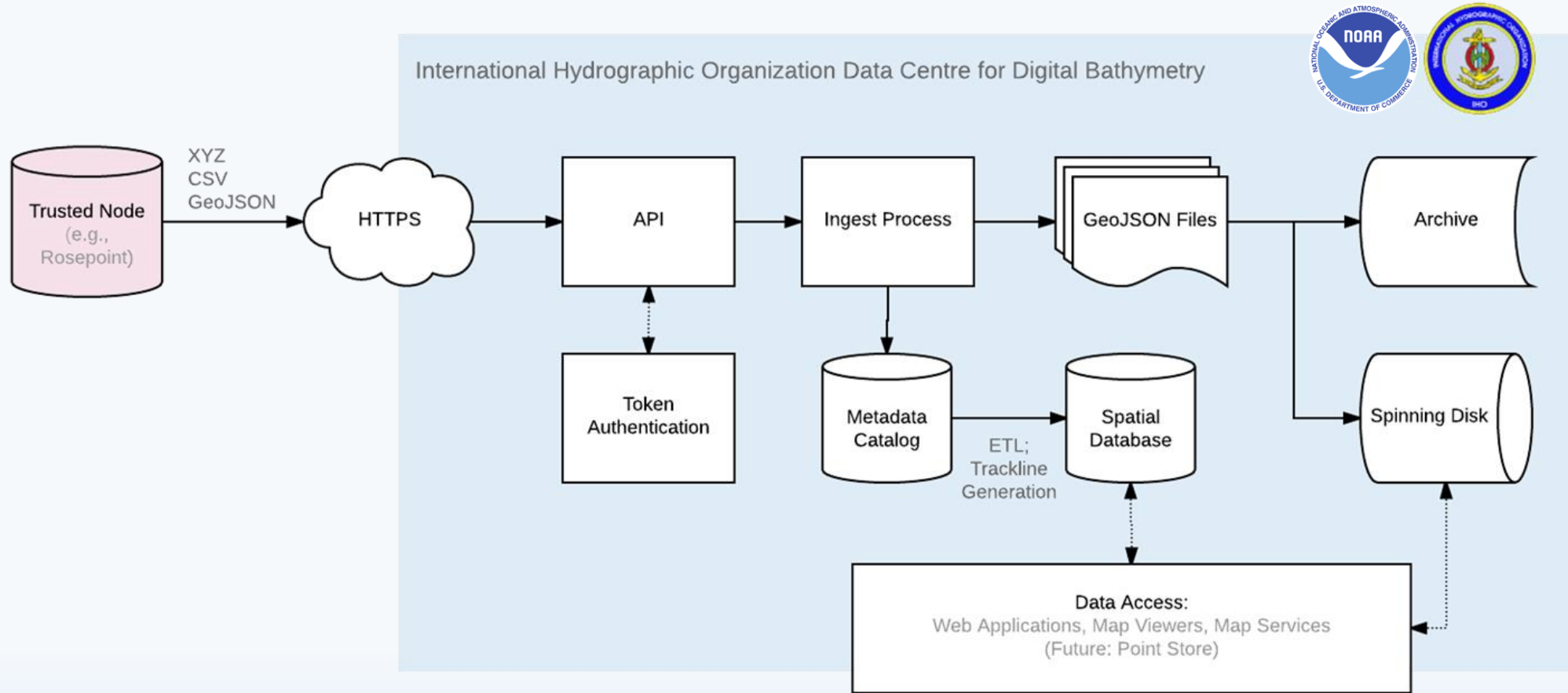
**Data and  
identifying token  
are submitted to  
DCDB via HTTP  
post**



**Frequent  
update of  
viewer**



# IHO DCDB CSB Pipeline





# IHO DCDB CSB Data Holdings

International Hydrographic Organization  
Organisation Hydrographique Internationale

Data Centre for Digital Bathymetry Viewer

Layers

- IHO DCDB/NOAA NCEI
  - Multibeam Surveys
  - Multibeam Bathymetry Mosaic
  - Single-Beam Surveys
  - Single-Beam Sounding Density
  - NOAA Hydrographic Surveys:
    - All Surveys with Digital Data
    - Surveys with BAGs
  - BAG Shaded Relief Imagery
- Search NCEI/DCDB Surveys [X] Reset
- Crowdsourced Bathymetry Files
- Search CSB Files [X] Reset
- U.S. Bathymetry Coverage and Gap Analysis

► Australia

► Canada

► EMODnet

► Bathymetric Coverage Maps

More Information

Help

Position: 179.738°, 26.613°  
Elevation: -5434 meters

- 154 million soundings
- 168 contributing vessels
- 6585 data deliveries



# CSB Next Steps: *Bring on more trusted data providers!!!*

We are currently working with *FarSounder, Macgregor, James Cook University, and CIDCO*

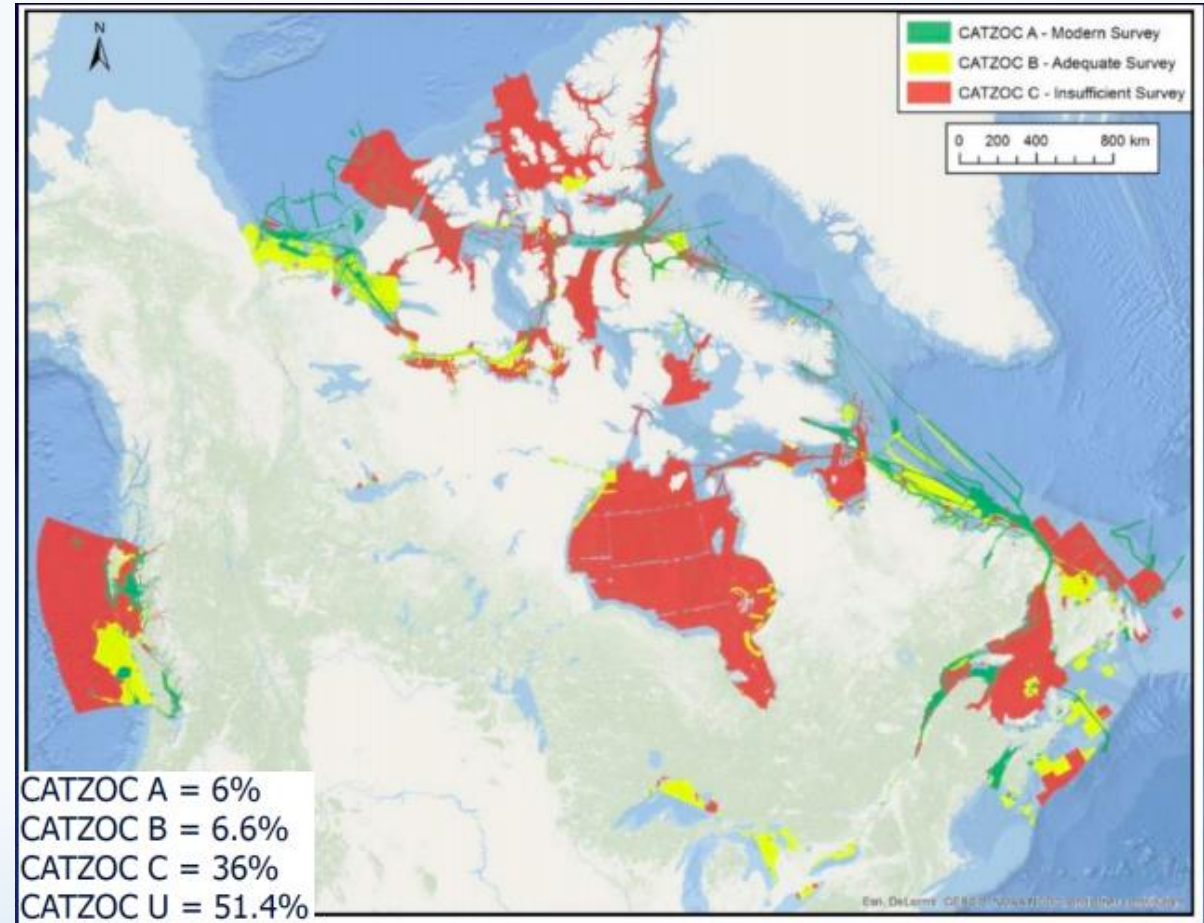


**CIDCO**  
Centre interdisciplinaire de développement en cartographie des océans  
Interdisciplinary Centre for the Development of Ocean Mapping

**Crowd Sourced bathymetry in Northern Canada (CSBNC)**

October 23rd 2019 (CSBWG, Monaco)

Logos for Marine Institute, COMREN, and INR Engineering are also visible.



About 47% of the 4.4 million km<sup>2</sup> of the Canadian Arctic is underwater and only 10% of these waters are adequately surveyed.



Int  
Orga



# CSB Next Steps: *Bring on more trusted data providers!!!*

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# FAR SOUNDER

A WHOLE NEW VISION UNDERWATER

## Update on FarSounder CSB Activities

IHO/NOAA CSBWG8  
October 2019

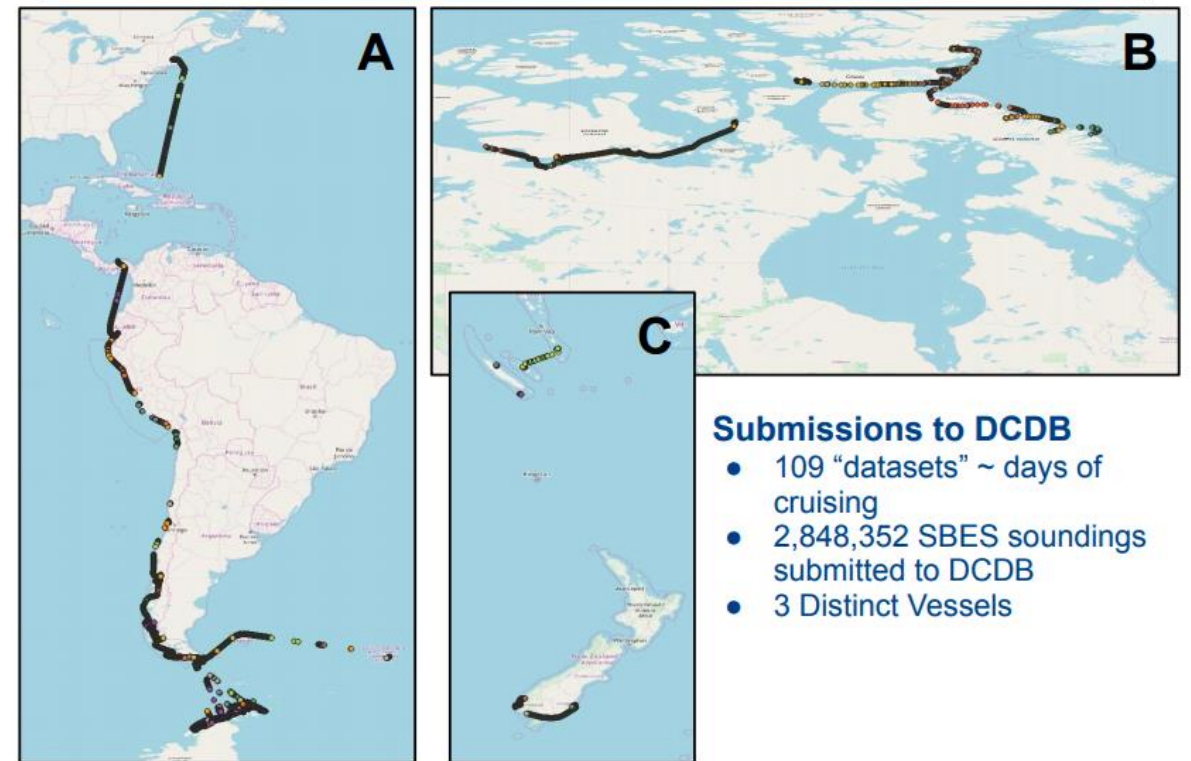
Presenter: *Heath Henley*  
Special thanks to *Austin Berard* - figures and analysis

FarSounder, Inc.

[www.farsounder.com](http://www.farsounder.com)

2019 Company Proprietary

## Overview of Data Submitted



FarSounder, Inc.

[www.farsounder.com](http://www.farsounder.com)

2019 Company Proprietary



International Hydrographic Organization  
*Organisation Hydrographique Internationale*



# CSB Data Flow (in a perfect world)

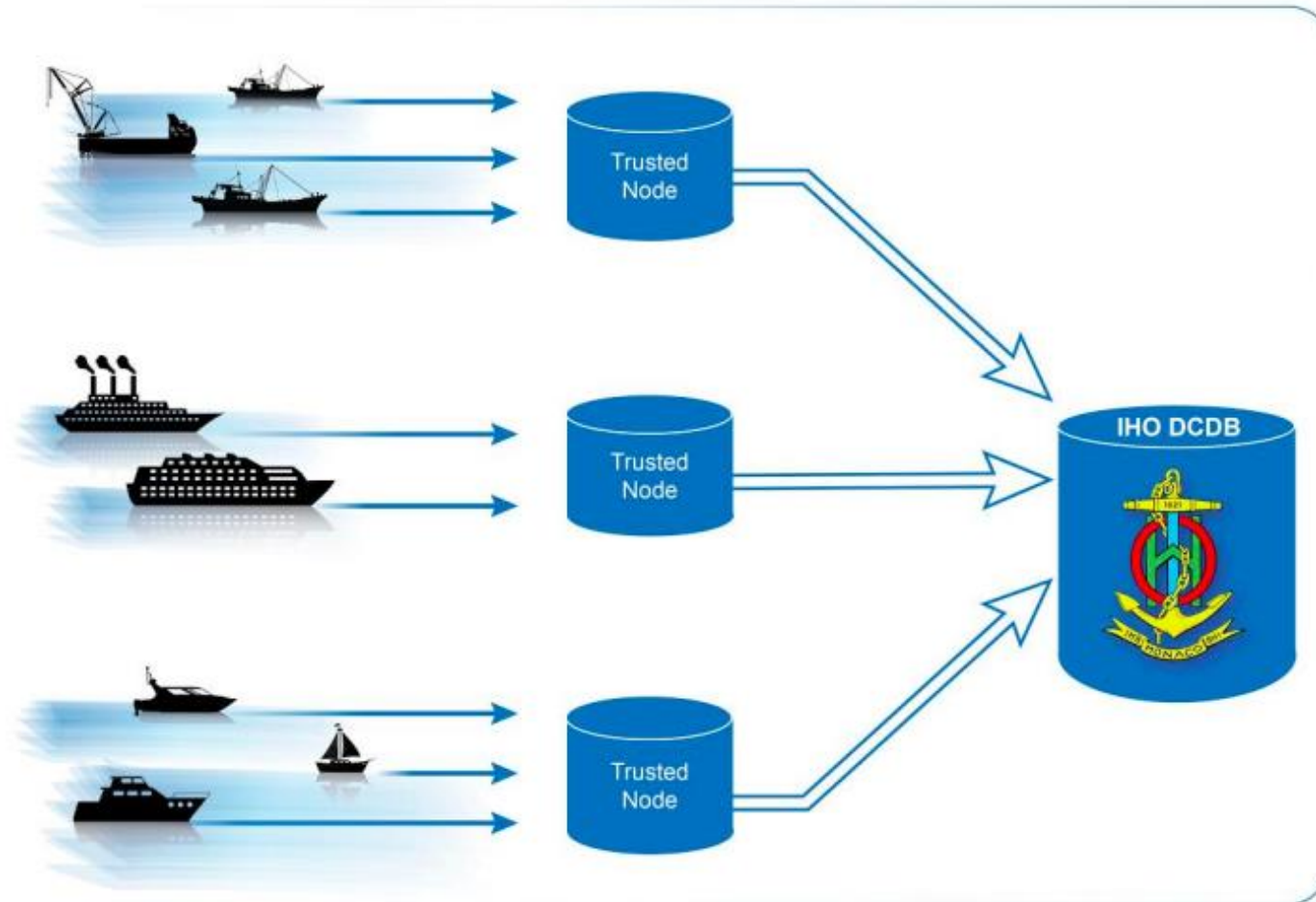
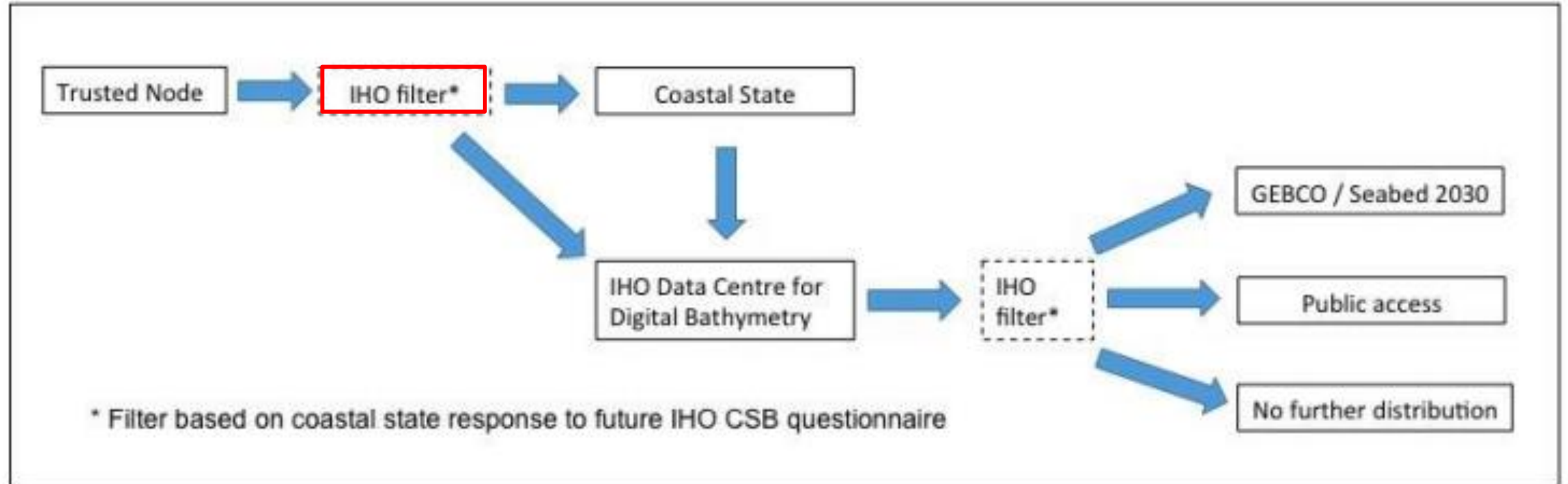


Figure 1. Data flow from vessels, through Trusted Nodes, to the DCDB.



# CSB Data Flow (in today's world)



Currently working to apply a set of topologically correct polygons for each EEZ & TS where each polygon is attributed with flags indicating the restriction(s) - YES/NO



# Geographic Filtering

- Based on the results of IHO Circular Letter 11, described in CL 47, the DCDB will filter out CSB data collected from the waters of **all coastal countries not included on the positive list of 13\***. This includes:
  - Countries we know are pro-CSB but haven't replied
  - Non-IHO member states
- Since CSB is stored as files (and NOT points), if any part of a file falls on or within a non-YES country's EEZ, it will not be made available.
- In most cases: 1 survey = 1 file

\* *Canada recently submitted a positive response*

## Summary analysis of positive responses

1. Based on the comments received to the questionnaire in Annex B to IHO CL 11/2019, the following table will be published as the Positive List to guide potential data gathering activities undertaken by the wider maritime community in waters of national jurisdiction:

Member State	Area	Specific actions required
Argentina	EEZ only	Provide copy of dataset to Hydrographic Office
Brazil	EEZ only	Provide copy of dataset to Hydrographic Office
Cyprus	All waters	Provide copy of dataset to Hydrographic Office
Denmark	All waters	Inform Hydrographic Office of any variance with published chart
Georgia	All waters	Provide copy of dataset to Hydrographic Office
Germany	All waters	Inform Hydrographic Office of new dataset
Monaco	All waters	Provide copy of dataset to Hydrographic Office
Netherlands	All waters	Inform Hydrographic Office of new dataset
New Zealand	All waters	Inform Hydrographic Office of new dataset
Norway	All waters – no multibeam activity without prior permission	Inform Hydrographic Office of new dataset
Philippines	Shipping routes and transit passages only	None
South Africa	EEZ only	Provide copy of dataset to Hydrographic Office
Sweden	EEZ only	Inform Hydrographic Office of new dataset
USA	All waters	None





### Crowdsourced Bathymetry

Fishing, tug boats, sailboats, cruise ships



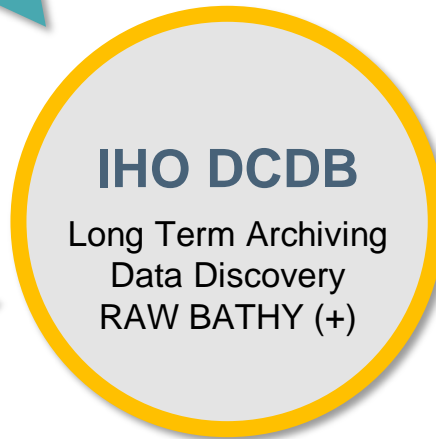
**International**  
eg: Ireland, Germany

**Industry**  
eg: Fugro



### Research & Exploration

UNOLS Fleet (26 vessels)



**NOAA Charting & Exploration**



**Public**  
(eg: HO's, industry, academic/research institutions)

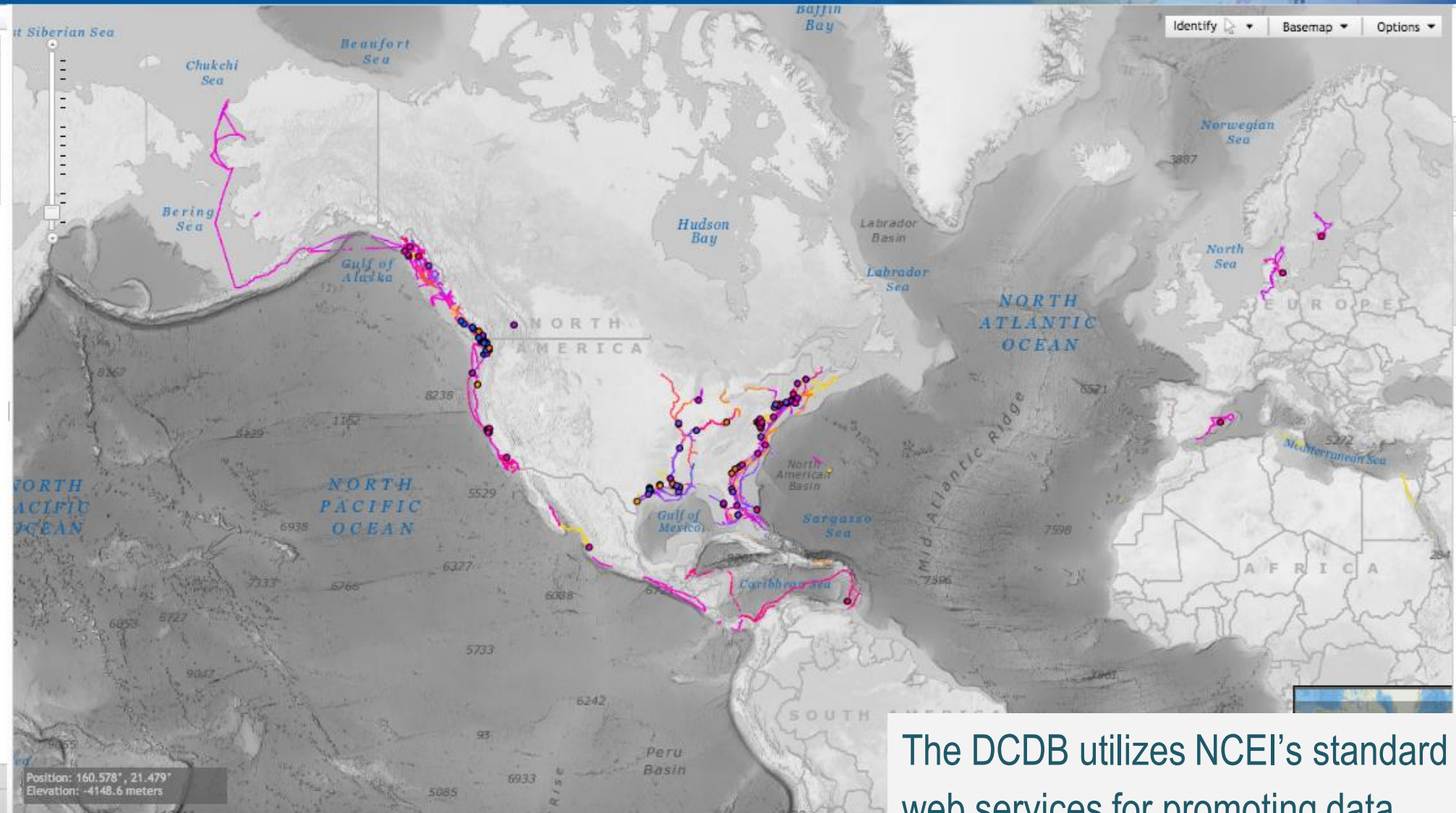
**Google ESRI**

**SB2030 RDACCs**





- Layers
- ▶ IHO DCDB/NOAA NCEI ?
  - ▶ EMODnet
  - ▶ Australia
  - ▶ Canada
  - ▶ France
  - ▶ Netherlands
  - ▶ Bathymetric Coverage Maps

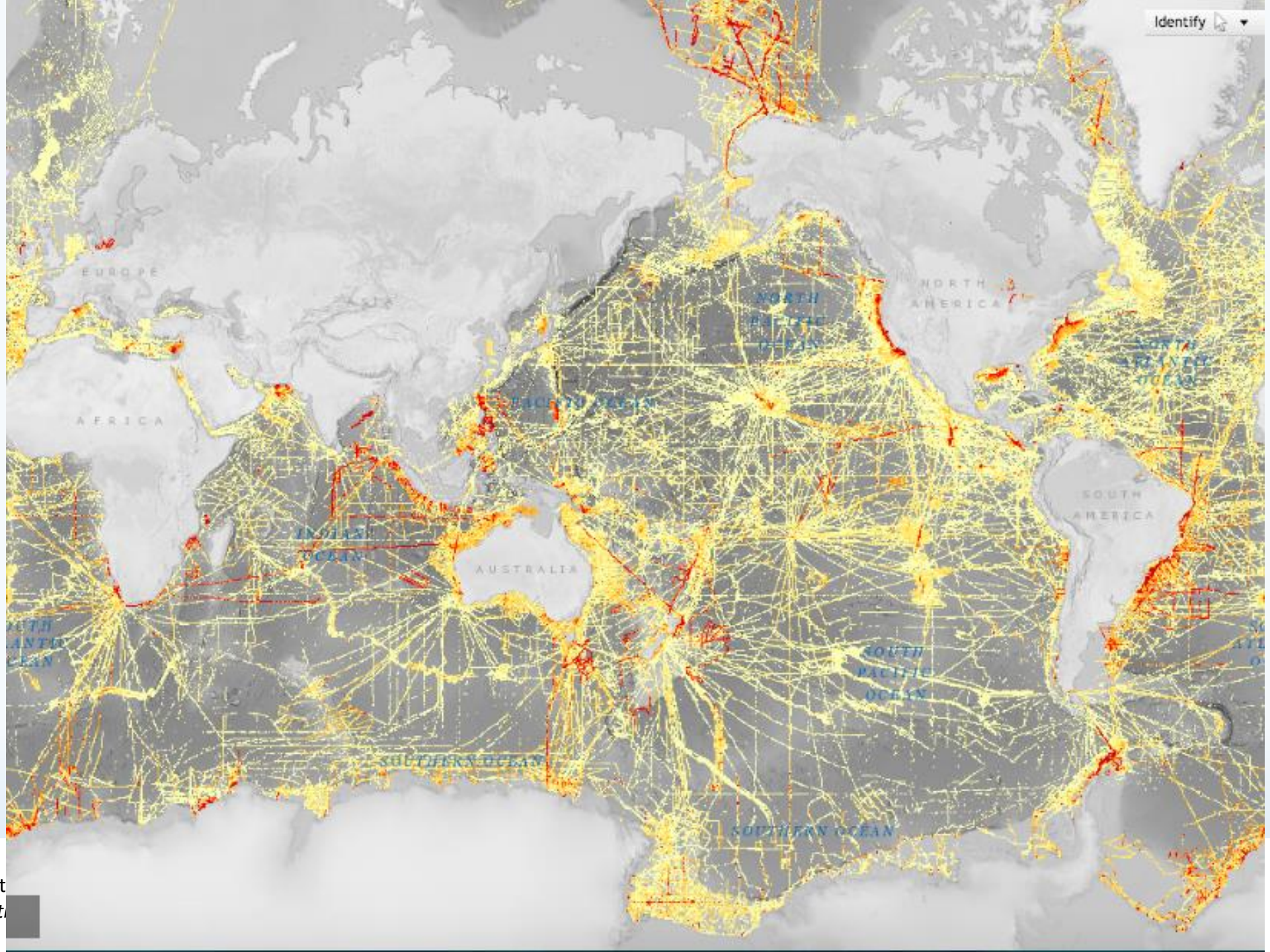


More Information  
 Help

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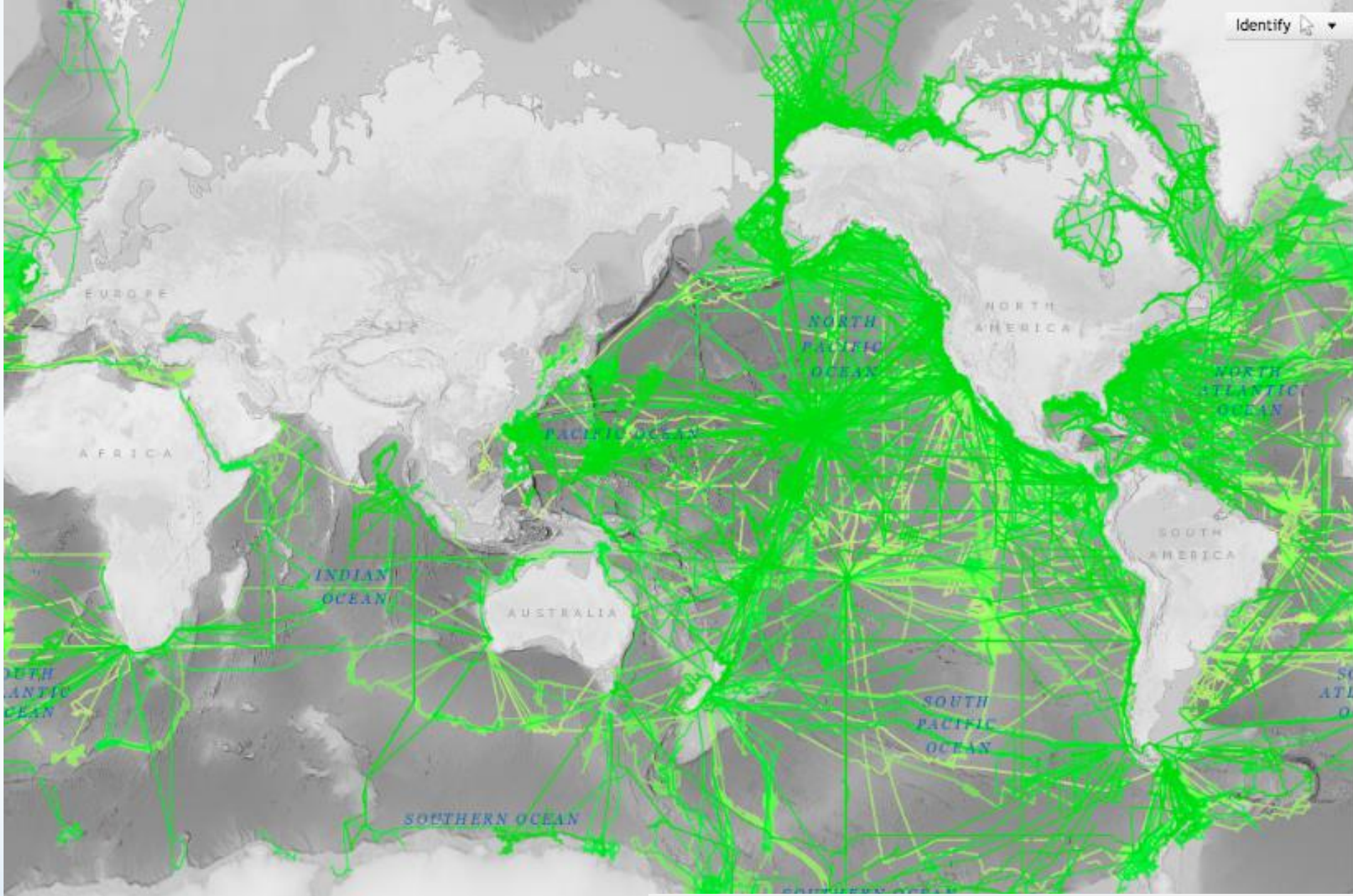






Internat  
Organisat



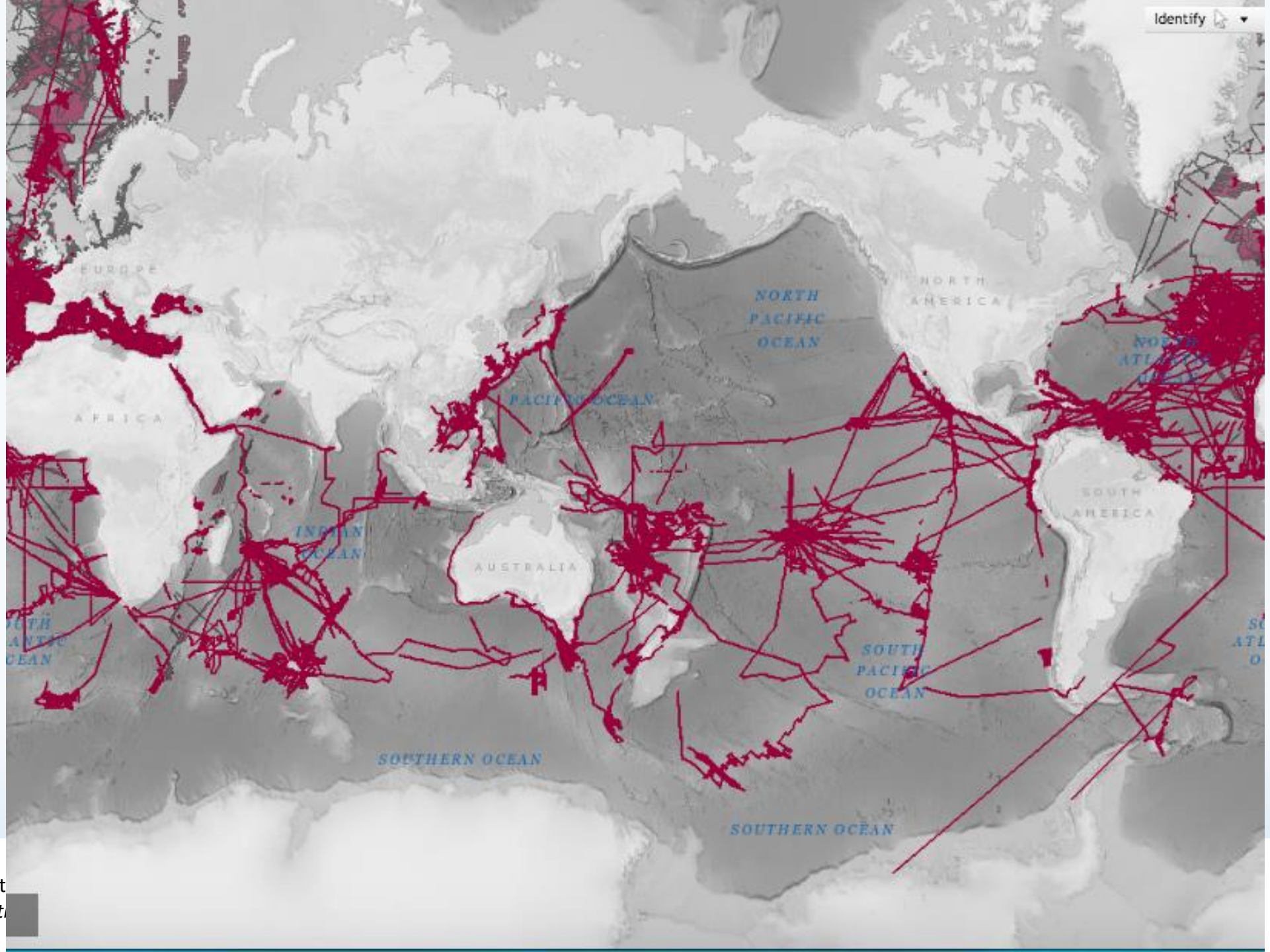


IHO DCDB = World Reference for Raw Bathymetry



Internat  
Organisati



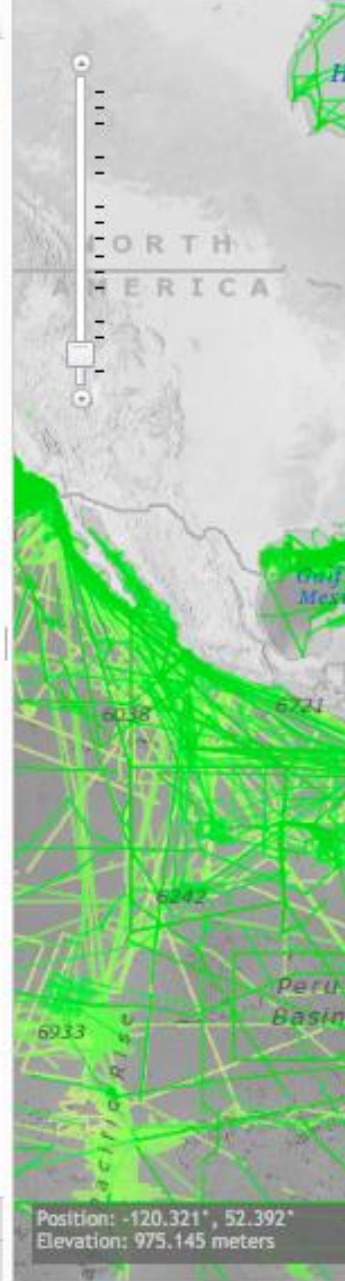


Internat  
Organisat



Layers

- ▶ IHO DCDB/NOAA NCEI [?](#)
- ▼ EMODnet
  - EMODnet Multibeam Surveys [?](#)
  - MAREANO Multibeam Surveys [?](#)
  - MAREANO Multibeam Shaded Relief [?](#)
- EMODnet Single-Beam Surveys [?](#)
- MAREANO Single-Beam Surveys [?](#)
- EMODnet Digital Terrain Model (DTM) [?](#)
- ▼ Australia
  - AusSeabed Bathymetry Holdings [?](#)
  - AusSeabed 50m Multibeam 2018 [?](#)
  - AusSeabed MH370 Phase 1 Data 150m [?](#)
- ▼ Canada
  - NRCan Multibeam Surveys [?](#)
  - NRCan Multibeam Shaded Relief [?](#)
  - Canadian Hydrographic Service NONNA-100 [?](#)
  - Fisheries and Oceans Canada 500m Bathymetry Compilation [?](#)
- ▼ France
  - SHOM Bathymetric Grids [?](#)
- ▼ Netherlands
  - Netherlands Caribbean Grids [?](#)
- ▶ Bathymetric Coverage Maps



More Information

Help







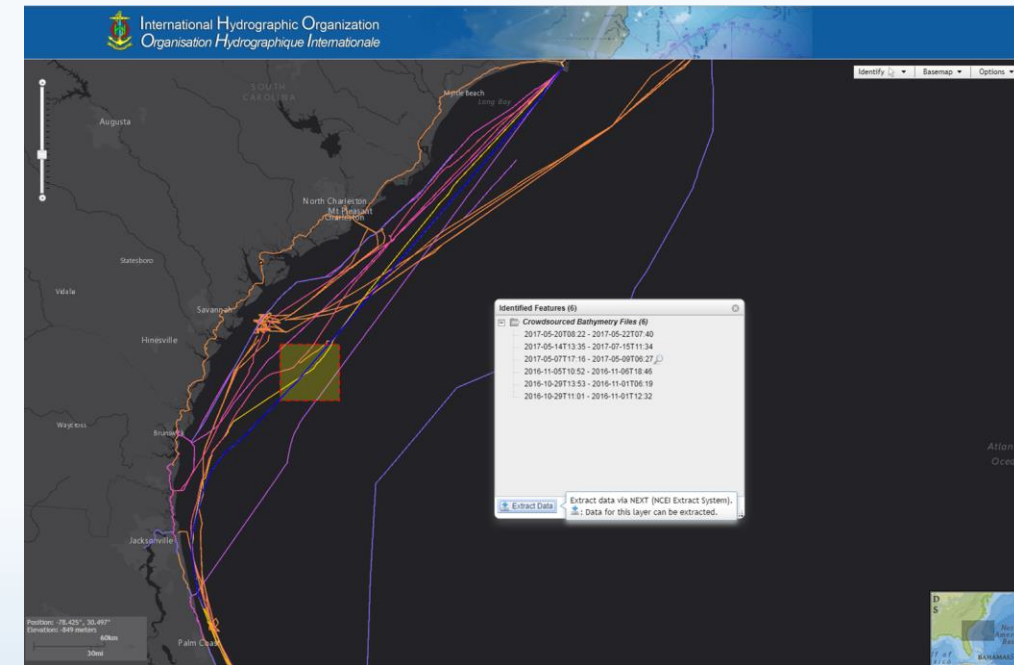
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# Next Steps

- Expand beyond pilot data provider to include more trusted data providers in CSB project
- Continue to ingest **map services** to provide a more accurate representation of where data exists
- Continue to ingest, archive, create tracklines of where data was collected to visualize on map, and provide individual file-based delivery of data.

## VISION

- To store ALL flavors of bathymetric data as a **seamless collection of points**
- Provide a variety of services, for ex:
  - Users can generate bathy grids of a given area using user-specified resolution
  - Show data density, guiding future data collection efforts

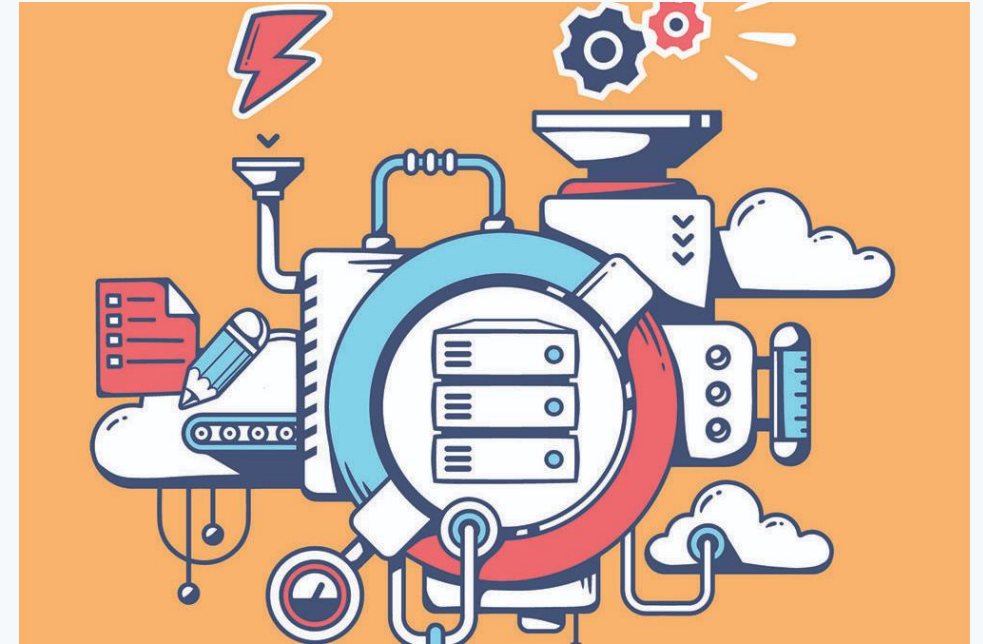




# Topics we would like to see discussed this week...

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1. Developing a data flow process between data contributors, the RDACC and the DCDB
  - a. What's the best way to get data to the DCDB?
  - b. What's the best way for the RDACC to access data from the DCDB?
  - c. What additional map services can be ingested in to the DCDB Viewer? (eg: JAMSTEC?)
2. How can we help you...
  - a. contribute data to the DCDB?
  - b. find and access data from the DCDB?







Thank you.

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