



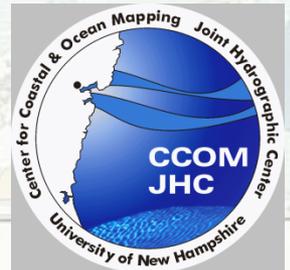
# Where are the Bathymetric Hot-Spots?

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# If I win really BIG at the Casino tonight

- Every now and then, there are news stories of someone winning \$100+ M in a lottery, and it's only human to dream of what one would do with that amount of money.
- Now that you are dreaming, what did you dream?
- Let me tell you mine—I would charter a research ship (with a deepwater multibeam) and offer it to each of you for a few weeks to go wherever you wanted, provided that you took it to a place where collecting new bathymetry data would contribute some new science or help solve some societal problem.
- Where would you take the ship?

# Why do I ask where you would go?

- Because I think the answer may help with a situation that frustrates all of us in GEBCO –
- Globally, the ocean floors are mapped to only low resolution and progress towards getting more measurements is disappointingly slow.

# Background

- In GEBCO all of us bemoan the lack of funding for collecting more deep-ocean bathymetry.
- We mumble the mantras of only ten percent of the ocean floor having been mapped / measured / heard a ping, of the far side of the moon being mapped to a higher resolution than the earth, of...
- Who do we say this to?
- Ourselves, mostly.

# We all know how little acoustic data we have

- Karen Marks slide on distance to nearest track
- GEBCO grid how many data points contributed

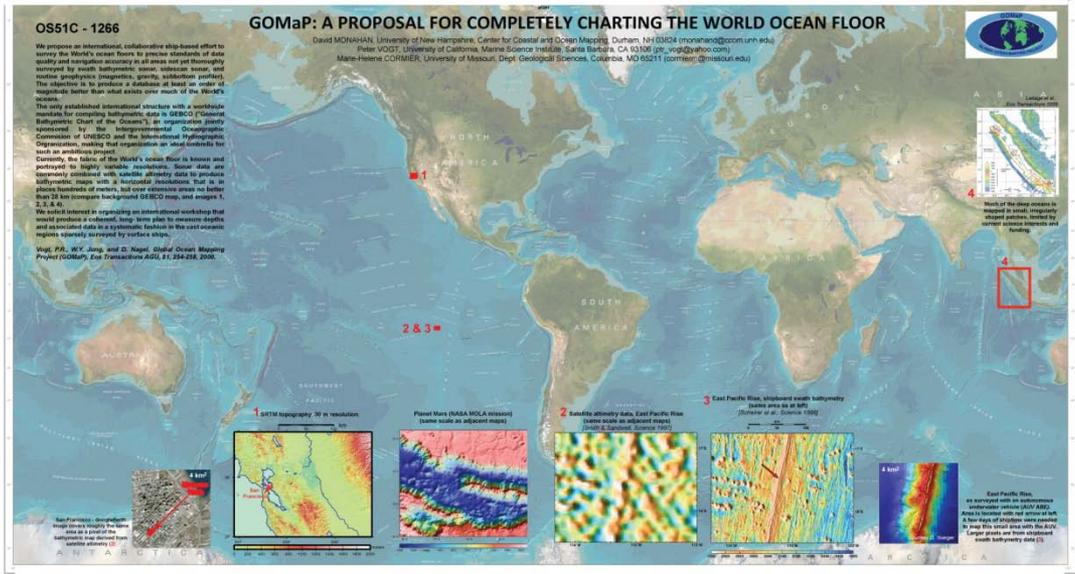


# What has been tried to overcome the paucity of acoustic data

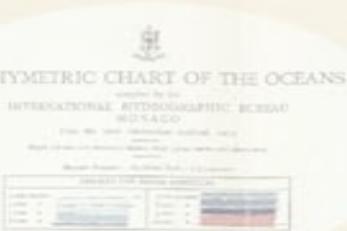
- Establishment of a world wide echosounding program
- Partnership with other world-scale marine science programs
- Programs by one or several institutions
- Crowd-sourcing
- Article 76 data collection
- National programs mapping own waters

# Establishment of a world wide echosounding program

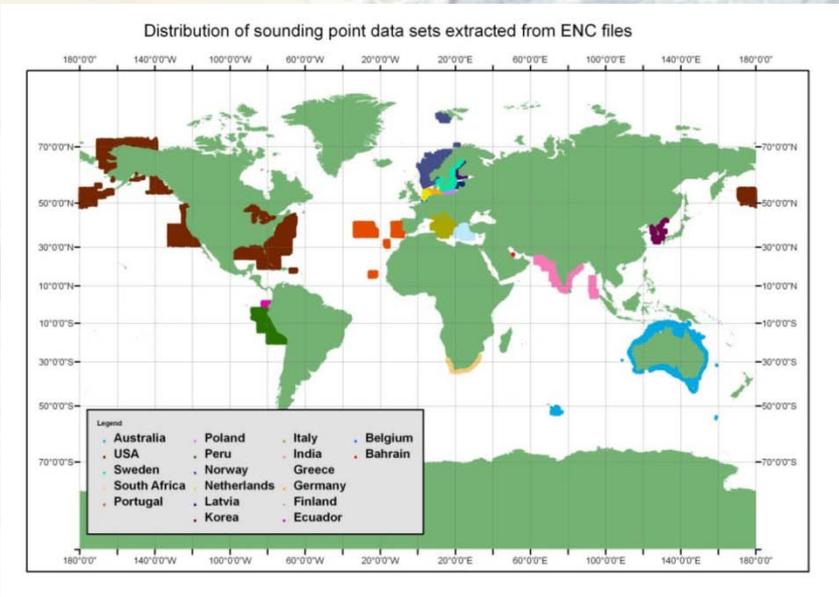
- Some of us have made efforts to develop world wide mapping programs.
- E.g. GOMaP
- No foreseeable Program



# Partnership with other world-scale marine science programs IHO



- Prime focus is on navigation depths, efforts concentrated in shallow water
- Copyrights /ownership / security issues for some countries
- Extraction of depths from ENC's



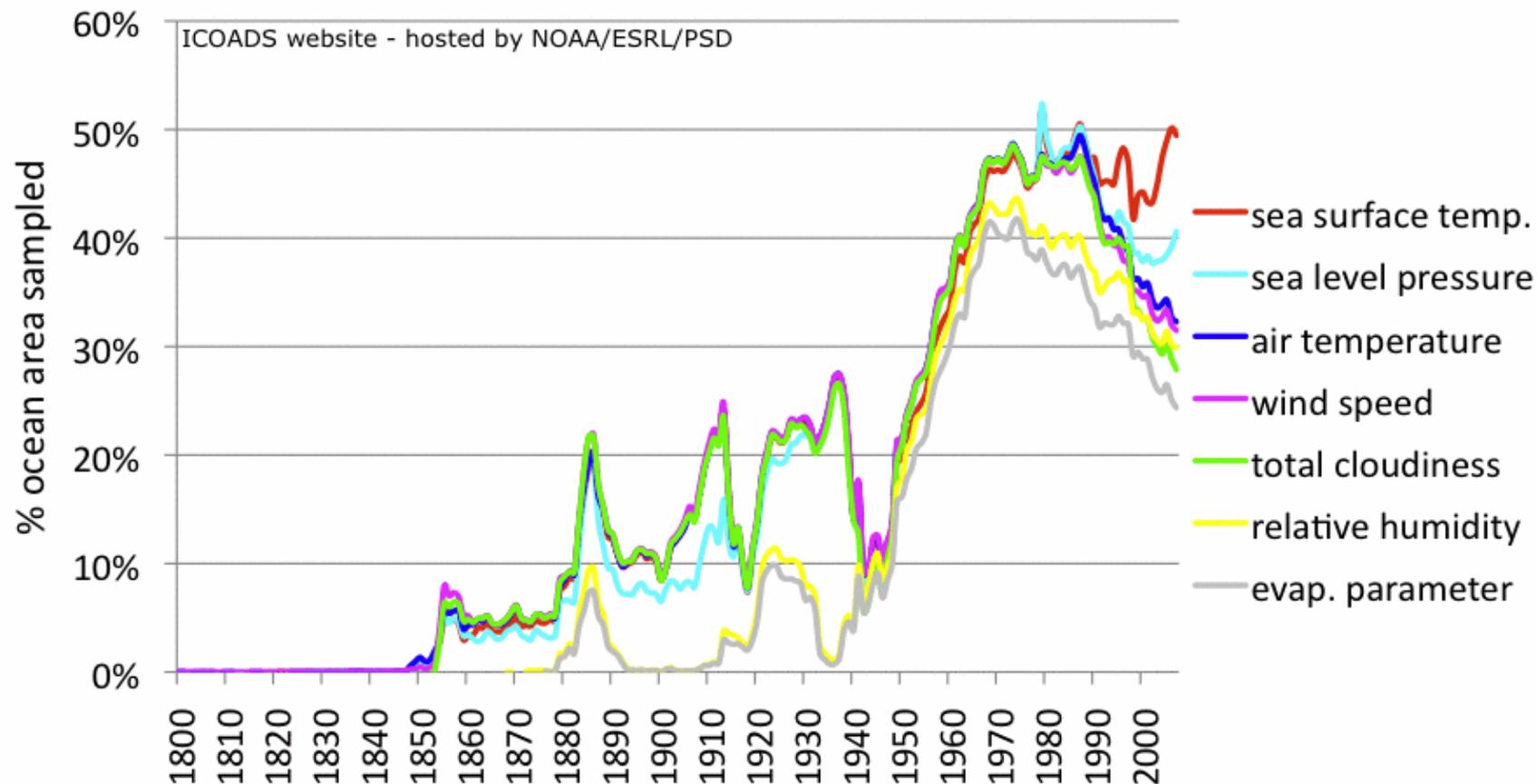
Partnership with other world-scale marine science programs

# IOC and Subsidiaries

- **Scientific Committee for Oceanographic Research**  
<http://www.scor-int.org/>
  - 2002 SCOR Working Group 107 “Improved Global Bathymetry” Report lists many uses for bathymetry and many recommendations for producing bathymetric data bases, maps and grids
  - 2005 GEBCO proposal to SCOR to establish a new Critical Bathymetric Studies Working Group was not supported

# Partnership with other world-scale marine science programs

## Deterioration of *in situ* marine observing system? – GCOS ECVs



# Partnership with other world-scale marine science programs

- What we generally hear from them is agreement that bathymetry is important and valuable and necessary BUT never in the top three on anyone's fund-me-now list.
- integration of data types—how do we link them? Eg no apparent link between meteorology and bath, lots of link between water physical prop and the measurement of depth
- lots of similarities between GEBCO and the other world ocean organizations –eg gaps, data centres and QC/std, southern ocean less data than north,-
- Differences between disciplines
  - Scale and resolution
  - Repeat measurements vs exploration
  - Time variable vs constant

# Programs by one or several institutions

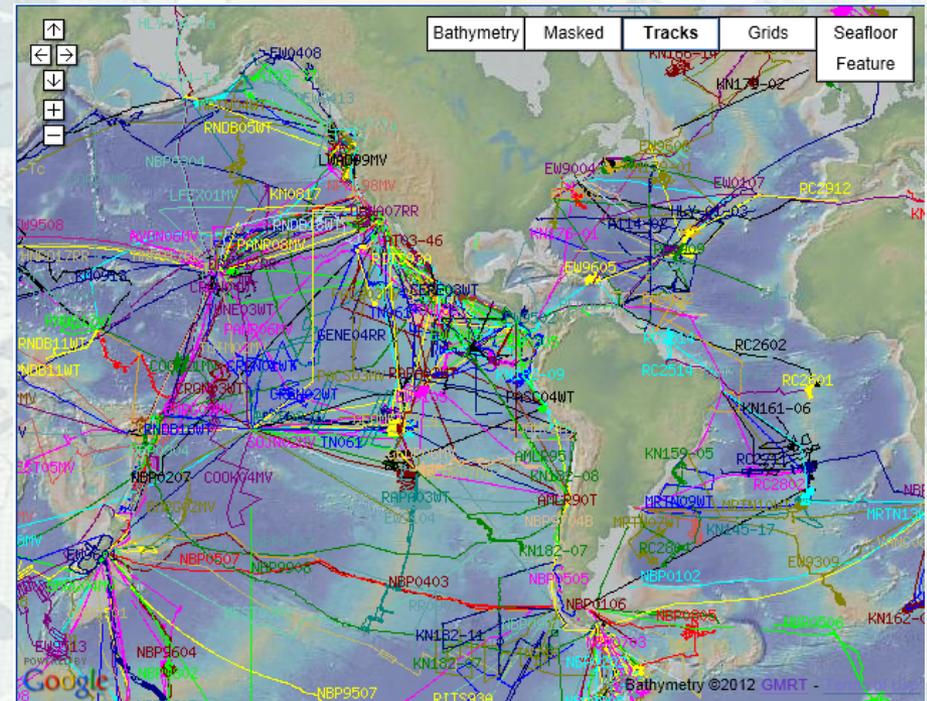
- GMRT
- Scripps
- More?



# Programs by one or several institutions

**Example GMRT** <http://www.marinegeo.org/portals/gmrt>

- **Global Multi-Resolution Topography synthesis** is a compilation of multibeam sonar data collected by scientists and institutions worldwide, **edited** and **merged** into a single **continuously updated** compilation

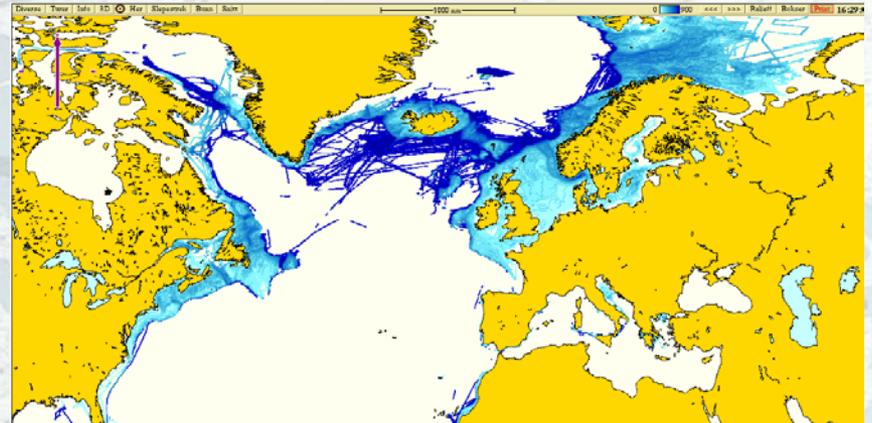


# Programs by one or several institutions

- Rolling Deck to Repository (R2R) Lamont, Scripps
  - Rolling together all the data collected by the US Academic fleet
  - <http://www.rvdata.us/overview>
- Satellite Geodesy Scripps
  - Grids of combinations of satellite altimetry and ships' acoustic data
  - <http://topex.ucsd.edu/index.html>

# Crowd-sourcing OLEX

- One surprising development in recent years is the OLEX company's success in getting fishermen to overcome their traditional reticence to tell anyone where they have been, and share echosounder measurements in fishing areas.
- Measurements collected in fishing areas, usually shallow but some is deep



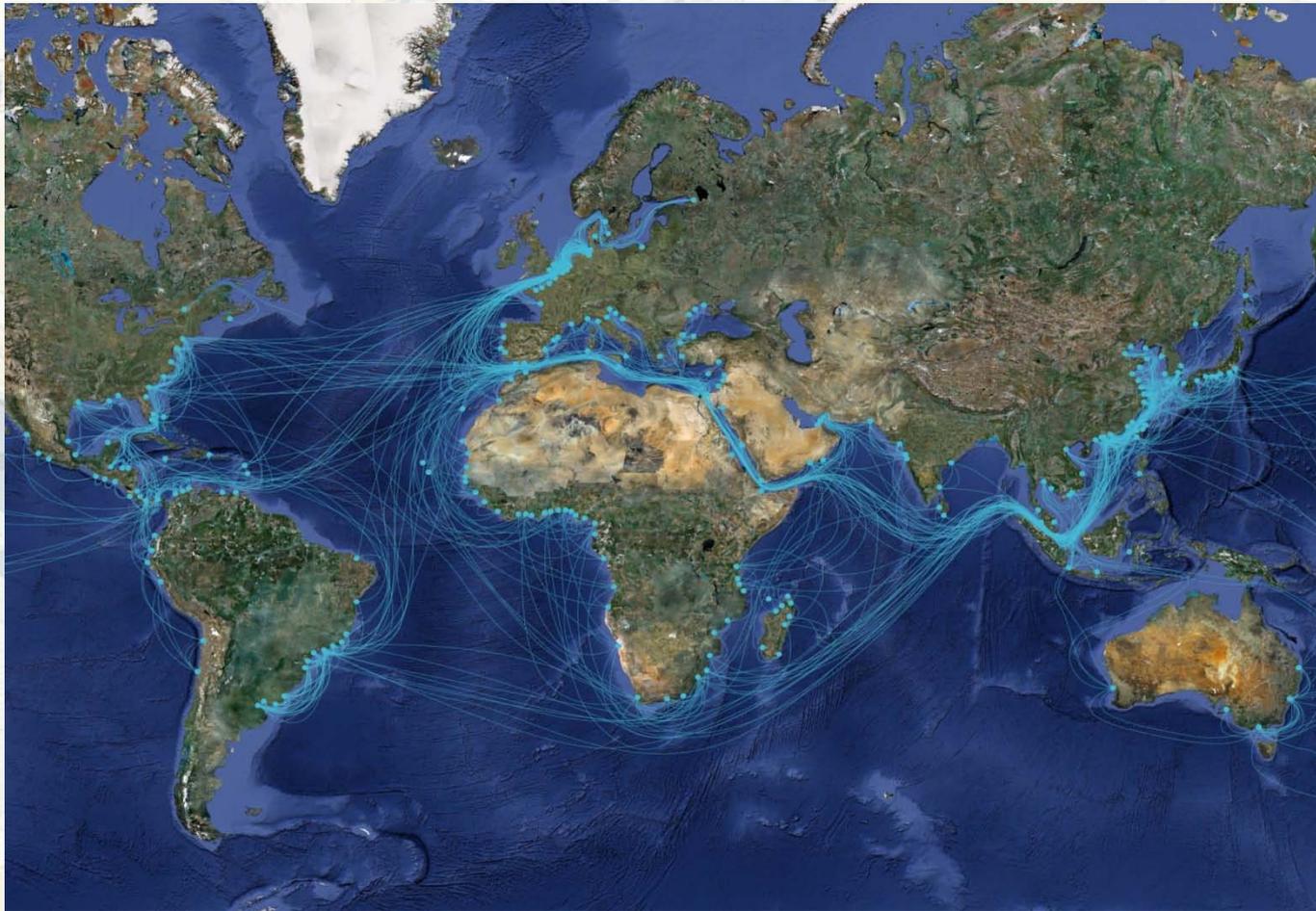
# Crowd-sourcing Shipping Industry

- The shipping industry, through its World Ocean Council, is showing willingness to collect "ocean" data, provided it does not interfere with the vessel's normal operations.
- a) Ocean is 360000000 sq km b) Average depth = 4 km c) Average MBES swath width on seabed at 2.5 times depth= 10 km
- So need a mbes swath  $360000000/10 = 36000000$  km long to cover it all
- 
- Container ships at sea average distance per year = 214,000 miles = 344000 km/yr
- 105 container ships could do the entire world ocean in one year
- 
- there are 90,000 container ships at sea!
- 
- So about one tenth of one percent of them could do it, in one year

# Crowd-sourcing But

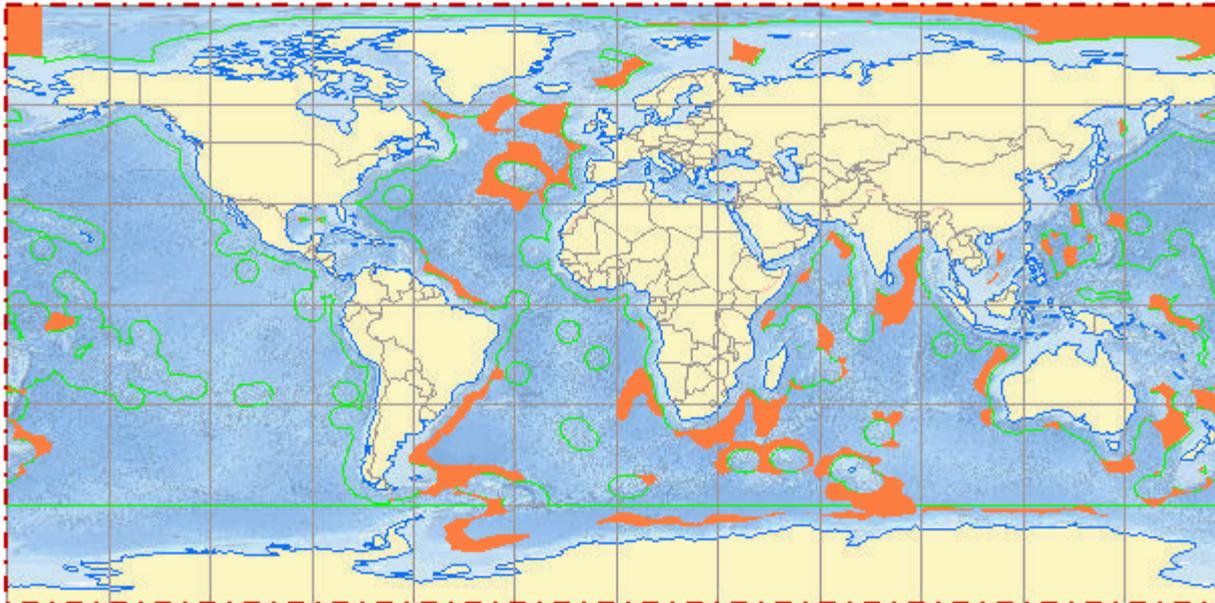
- Ships stick to regular routes and schedules
- They will only accept a program that does not interfere with their route or crew
- We would have to provide a self-contained instrument package that does not require power or holes in the hull
- Ships' own echosounders are for navigation:
  - Depth limited < 2000m
  - Single beam
  - Quality of signal at 25kts?
  - Recording depth and position? Transmitting data?
  - Velocity of sound corrections?

# Shipping Routes (Maersk)



# Article 76 data collection

- What has/will happened to the sounding data collected for Article 76?
- Once a Coastal State has declared its Juridical continental shelf, the data collected to map the Foot of the Slope and the 2500 m contour should be made public



Map from UNEP

# National programs mapping own waters

- Restricted to few nations and shallow waters
- Results, where there are any, are usually available



# The net result

- Everyone agrees that bathymetry is important
- Many think that it is done well enough now or at least well enough to not take resources from other science issues
- Lots of progress in shallow waters
- The deep ocean is still being measured only by sporadic, irregular cruises
- There are many GAPS—in fact, there are many times more gaps than filled areas
- In the absence of any program to measure the entire seafloor, we are left with trying to fill the gaps

# How do we fill gaps?

Filling the gaps requires both:

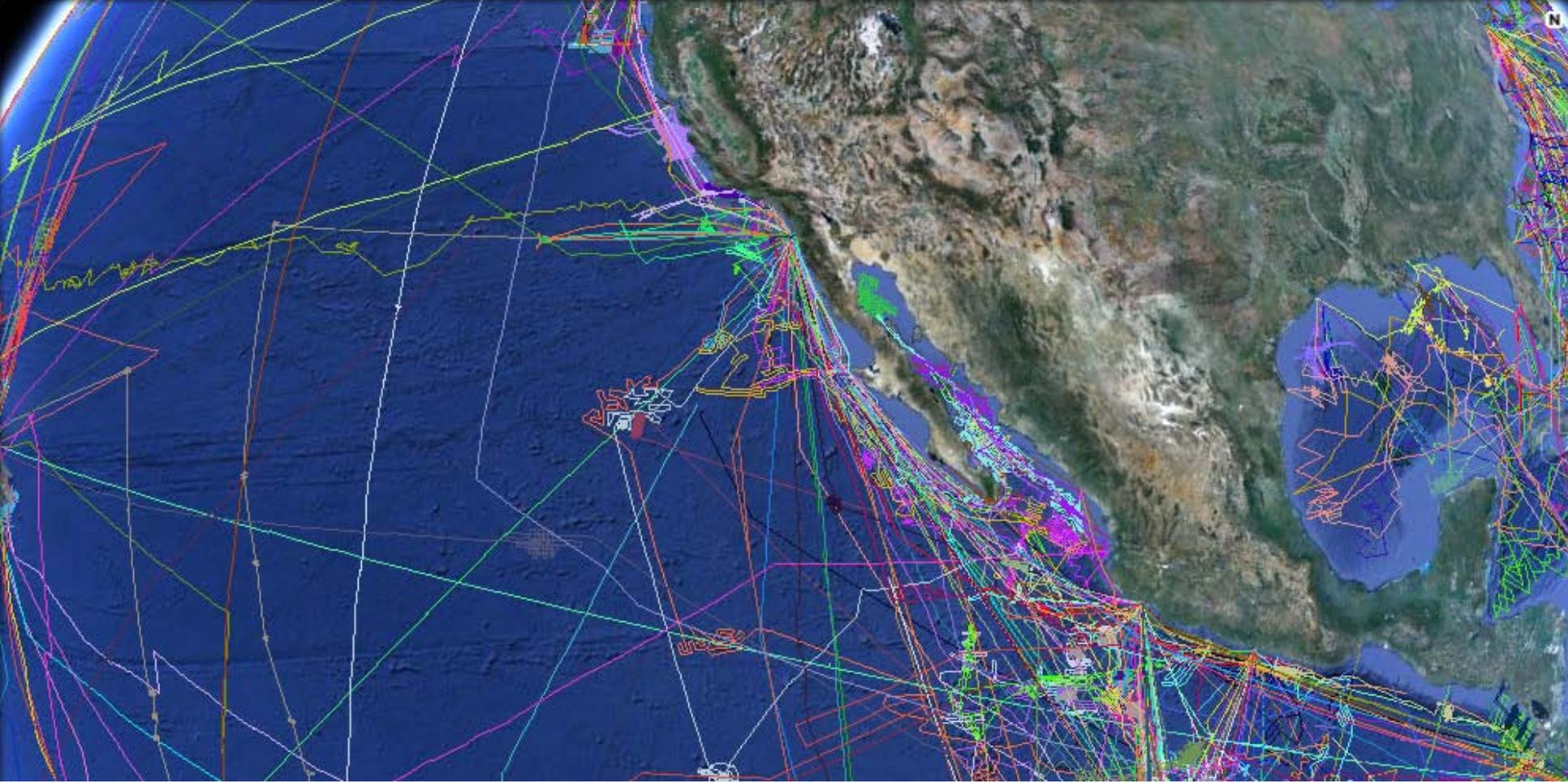
a) Technical and Scientific Actions and

**b) Organizational and Management Actions**

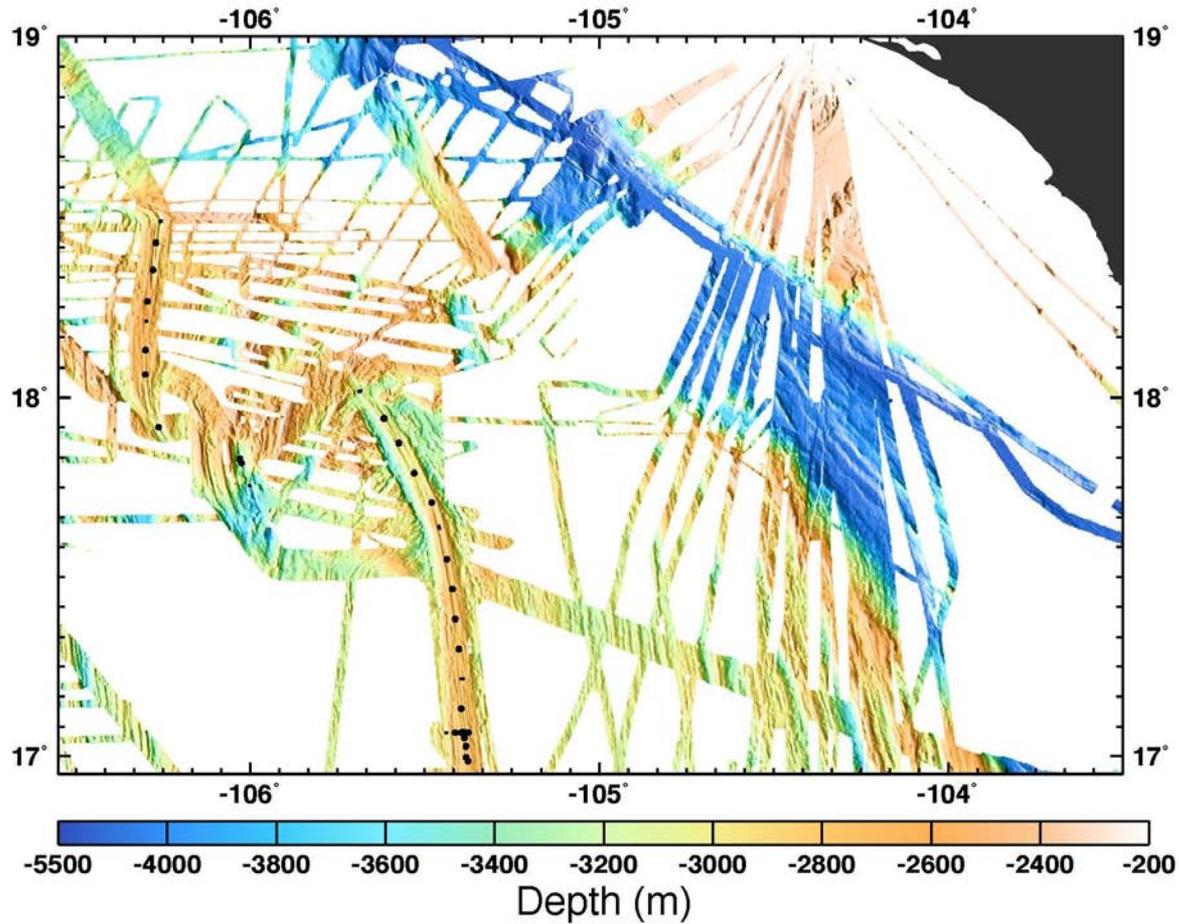
- Ask first whether ALL the gaps need to be filled
  - Diminishing returns
  - Where to first? Priorities

# Look at gaps

ASYMMETRIC CHART OF THE OCEANS



# Look at Gaps 2



# Possibilities for filling the gaps

- Fill with predictions
- Fill with measurements
  - Regular routine measurements
  - Irregular opportunity measurements
  - **Deliberately focused measurements**

# To obtain deliberately focused measurements

- Show why the data are needed
- Show that the data will be used and the collector acknowledged
- Show where we can get the most return the soonest

# What you can do

- Return to my Casino Win question – where will you take the ship ?
- You wouldn't waste the opportunity
- Everyone has a spot where there is some mystery, some feature not resolved, some location where better bathymetry would make for better oceanography, @
  - Eg Give highest priority to mapping unknown areas, particularly remote areas with islands that can be used as tie points in existing satellite derived bathymetry maps.
- eg Emphasize mapping in regions where knowledge of fisheries habitats is paramount
- Francis Bacon "Write down the thoughts of the moment. Those that come unsought for are commonly the most valuable. ."

# A suggestion

- Everyone writes a few hundred words about their special hot spot ( a map would be good too)
- We compile them into a paper that demonstrates the range of unsolved problems and the vitality and relevance of bathymetry
- Publish in EOS or Nature or the like
- Raise awareness and get more relevant data collected

# Thoughts about Top Ten Lists

- Google “Top Ten” and get “About 1,030,000,000 hits”
- One could be skeptical and argue that Top Ten lists have been over-used
- OR
- One could argue that people like Top Ten Lists and have come to expect them

# Benefits

- Raise and remind other sciences of the value of bathymetry
- Help support cruises to the specific areas
- Students can be given finding and justifying a hot spot as an assignment
- (DSDP and its descendants does something similar for site selection - to good effect)

# Template for Your Location

- I want to use Dave's boat for ... days
- Identify Yourself...
- Where do you want to go?...
  - Index map, place name if it has one
- What scientific or societal problem will taking the ship there contribute to solving? ...
  - As much background as needed, who else has been there, data needed

# Who is in?

- If you are too shy to raise your hand now, then email me at [monahand@ccom.unh.edu](mailto:monahand@ccom.unh.edu)
- Or talk to me during the break
- Or if the GEBCO Guiding Committee endorses this proposal (on Friday) then I hope it will have a spot on the GEBCO website