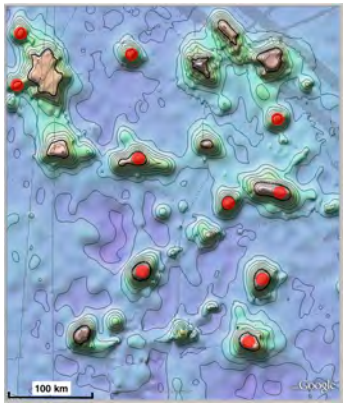
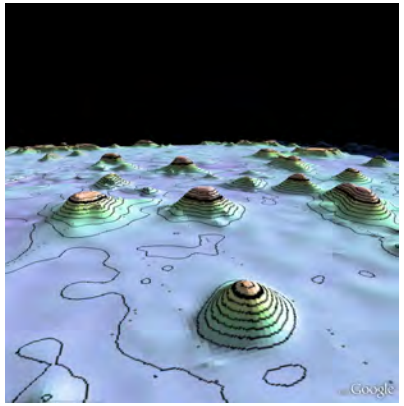


Global Predicted Bathymetry for Google Earth and Beyond

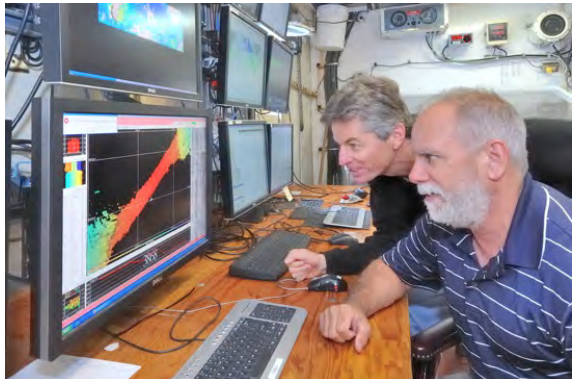
David Sandwell
Scripps Institution of Oceanography

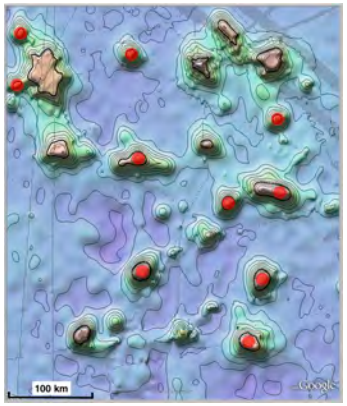
JJ Becker
Naval Research Laboratory



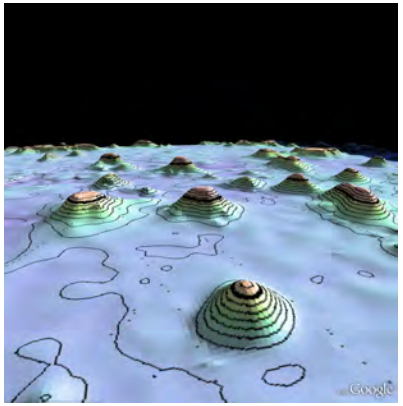
Objective – construct the best possible map of the ocean floor for science, public outreach, and applications.

- Needs for improved bathymetry
- Global marine gravity and predicted depth
- Proposed tasks (draft)
- Timeline





Needs for Improved Bathymetry



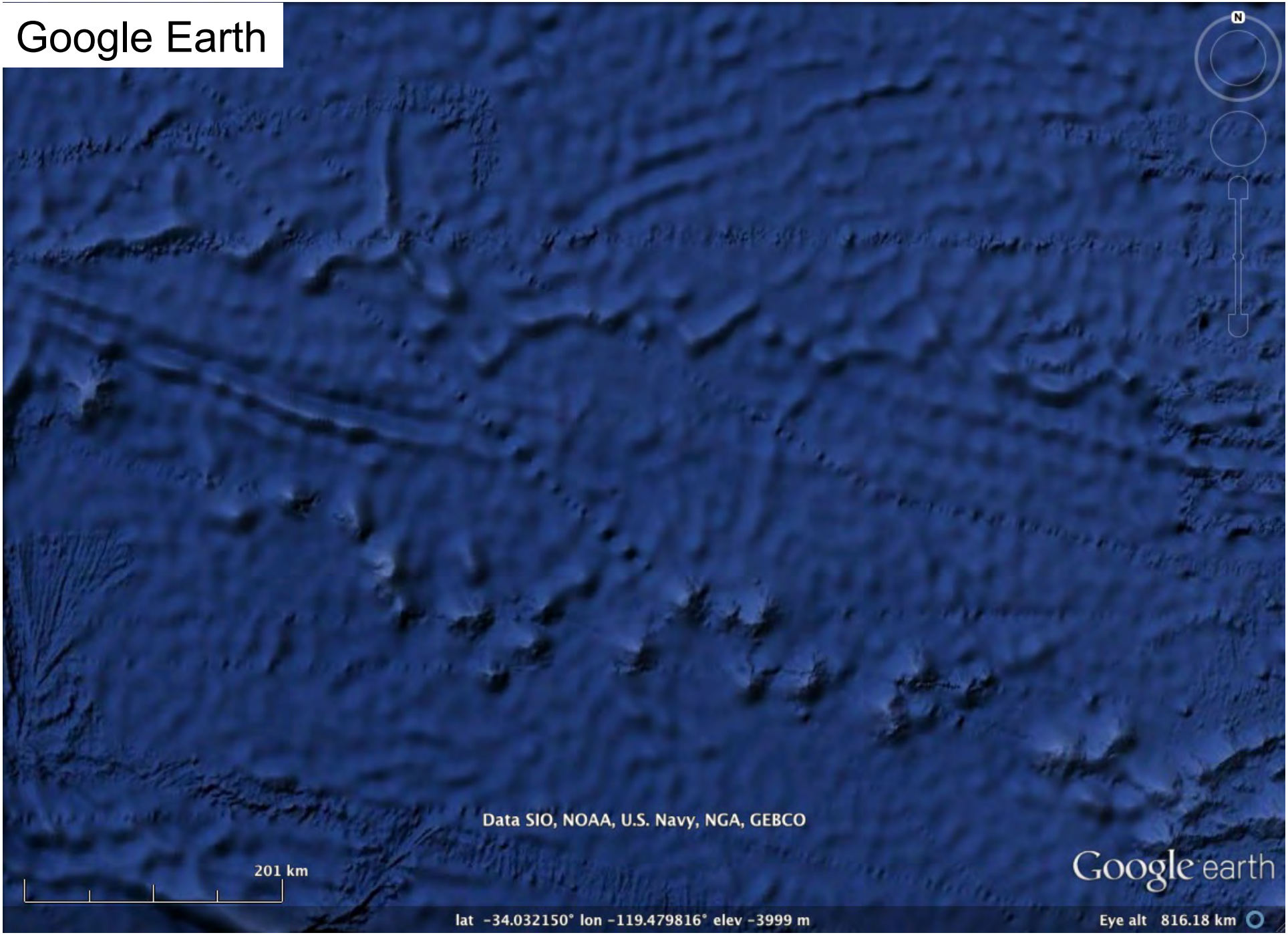
Science

- global tectonics, seafloor roughness
- seamounts
- tsunami models
- ocean circulation and tides
- marine ecosystems
- **planning tool - GE**

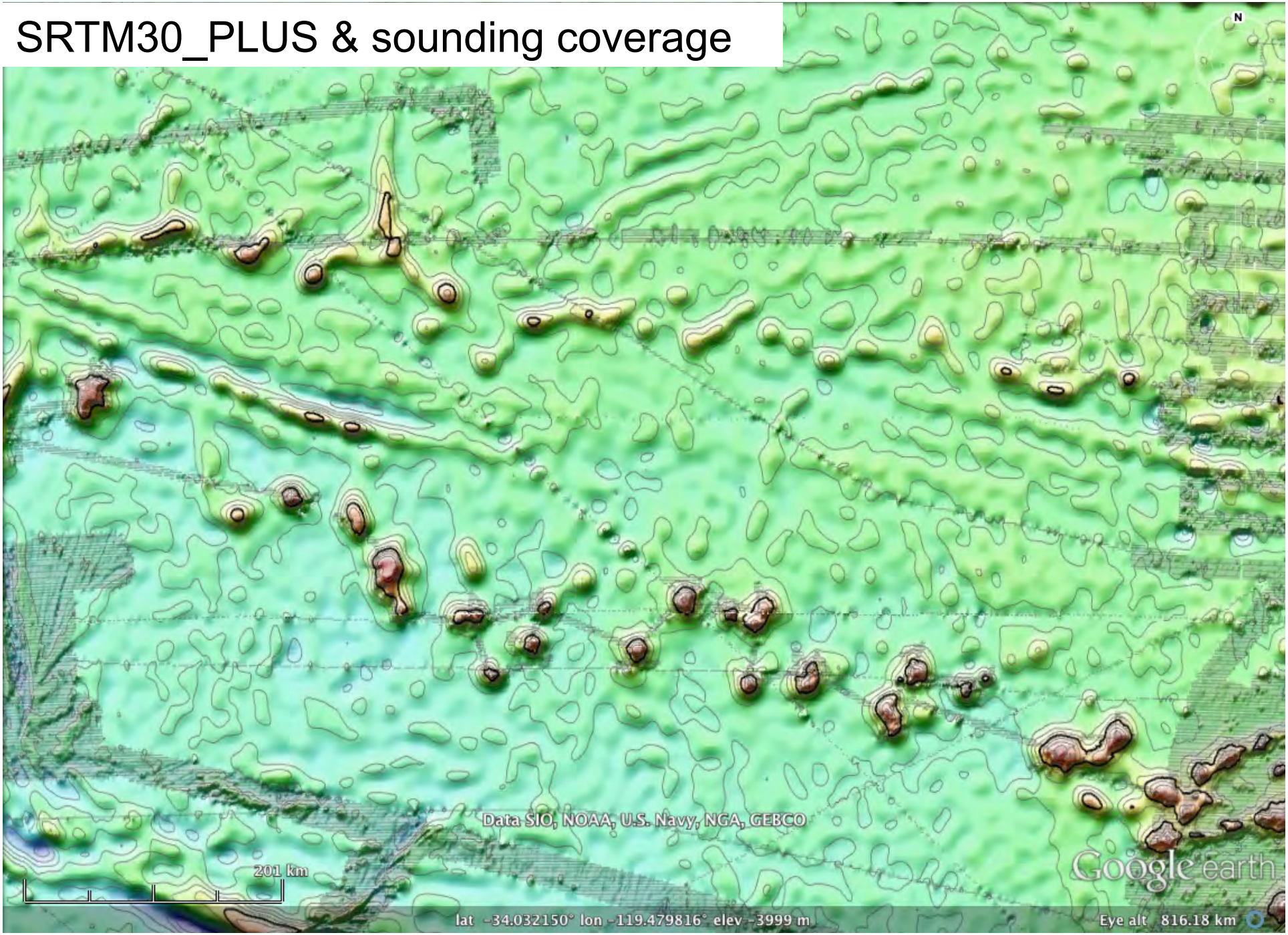
Outreach and applications

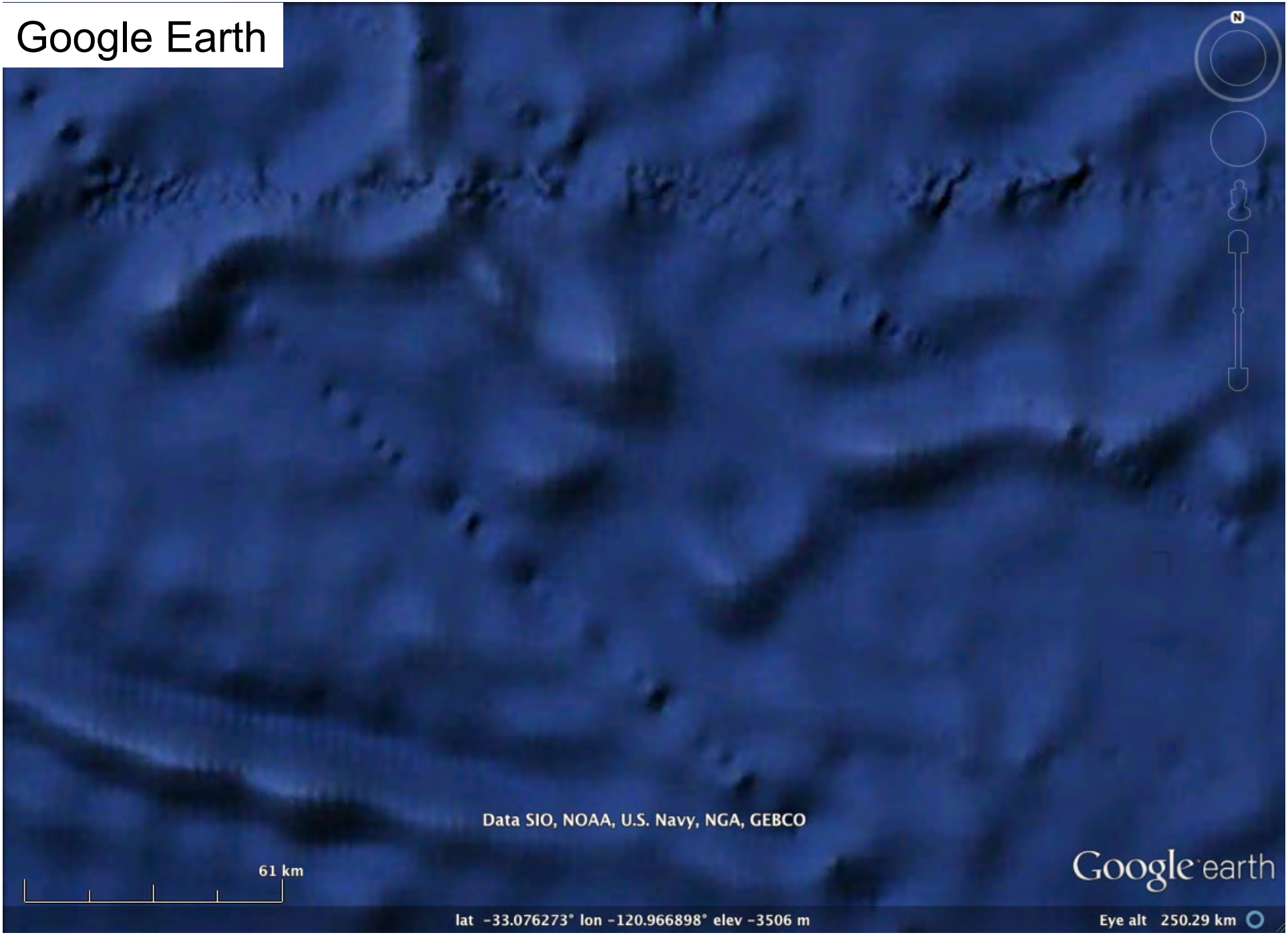
- **education and outreach - GE**
- military applications
- Industry applications

Google Earth

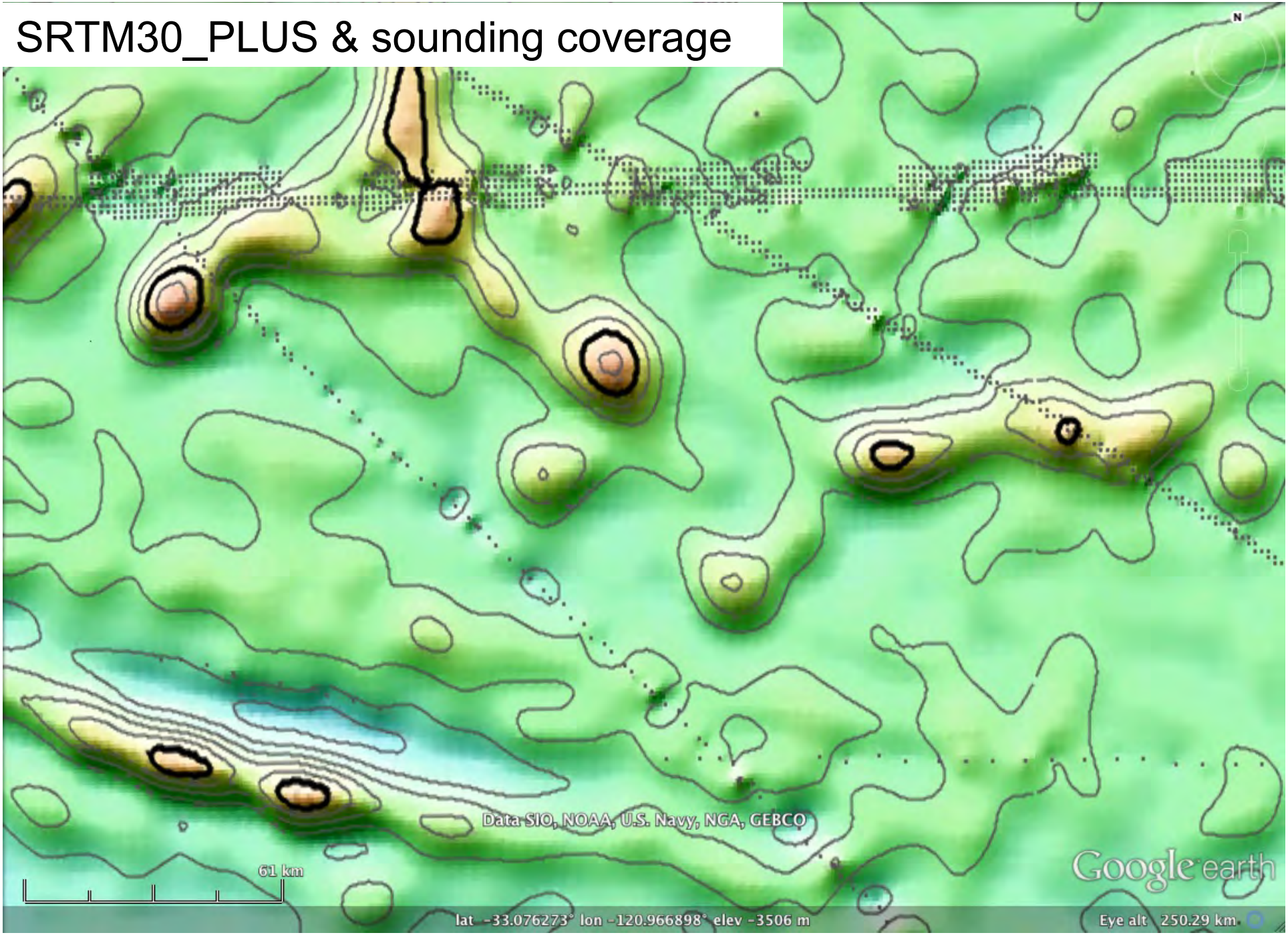


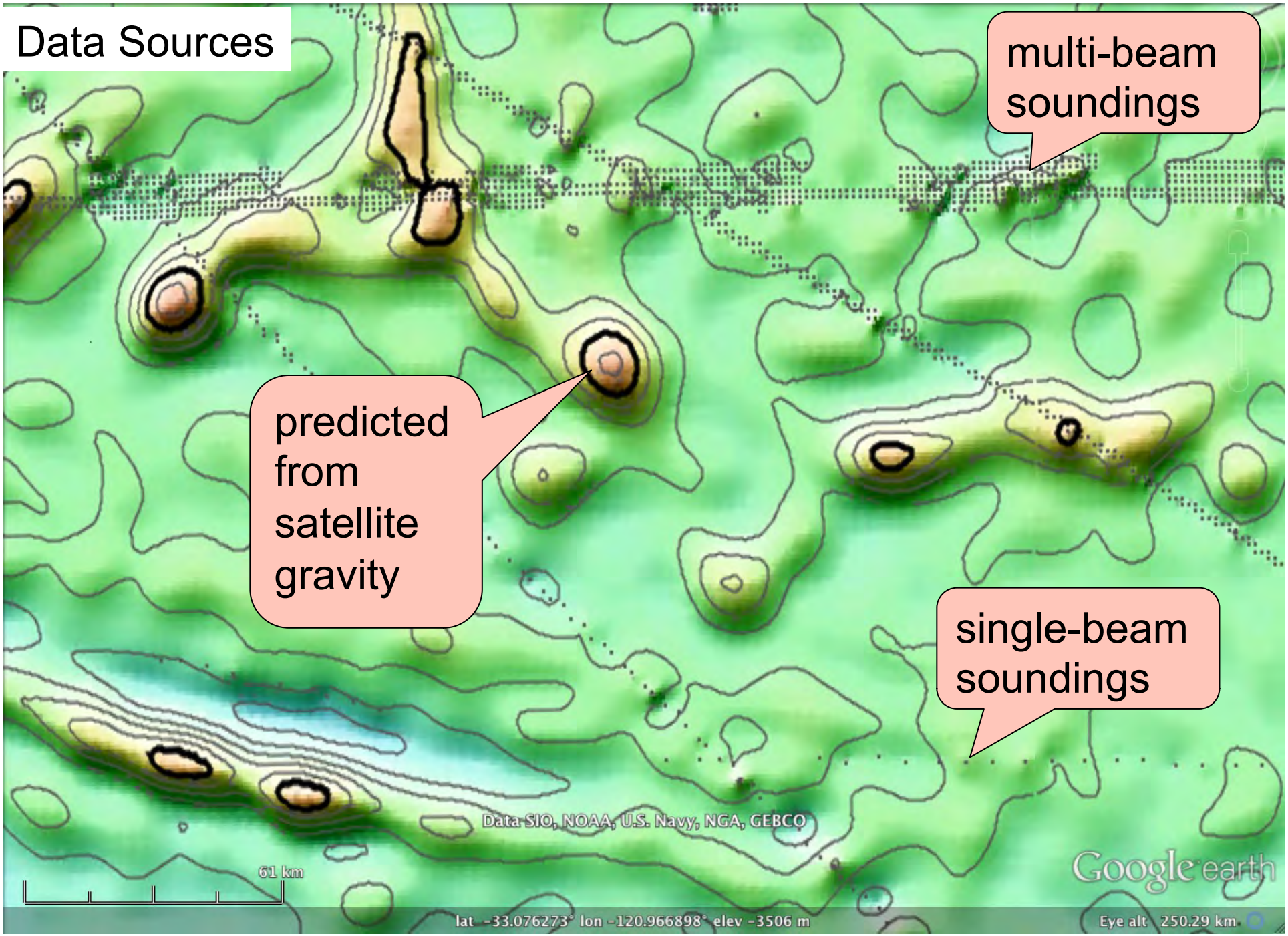
SRTM30_PLUS & sounding coverage



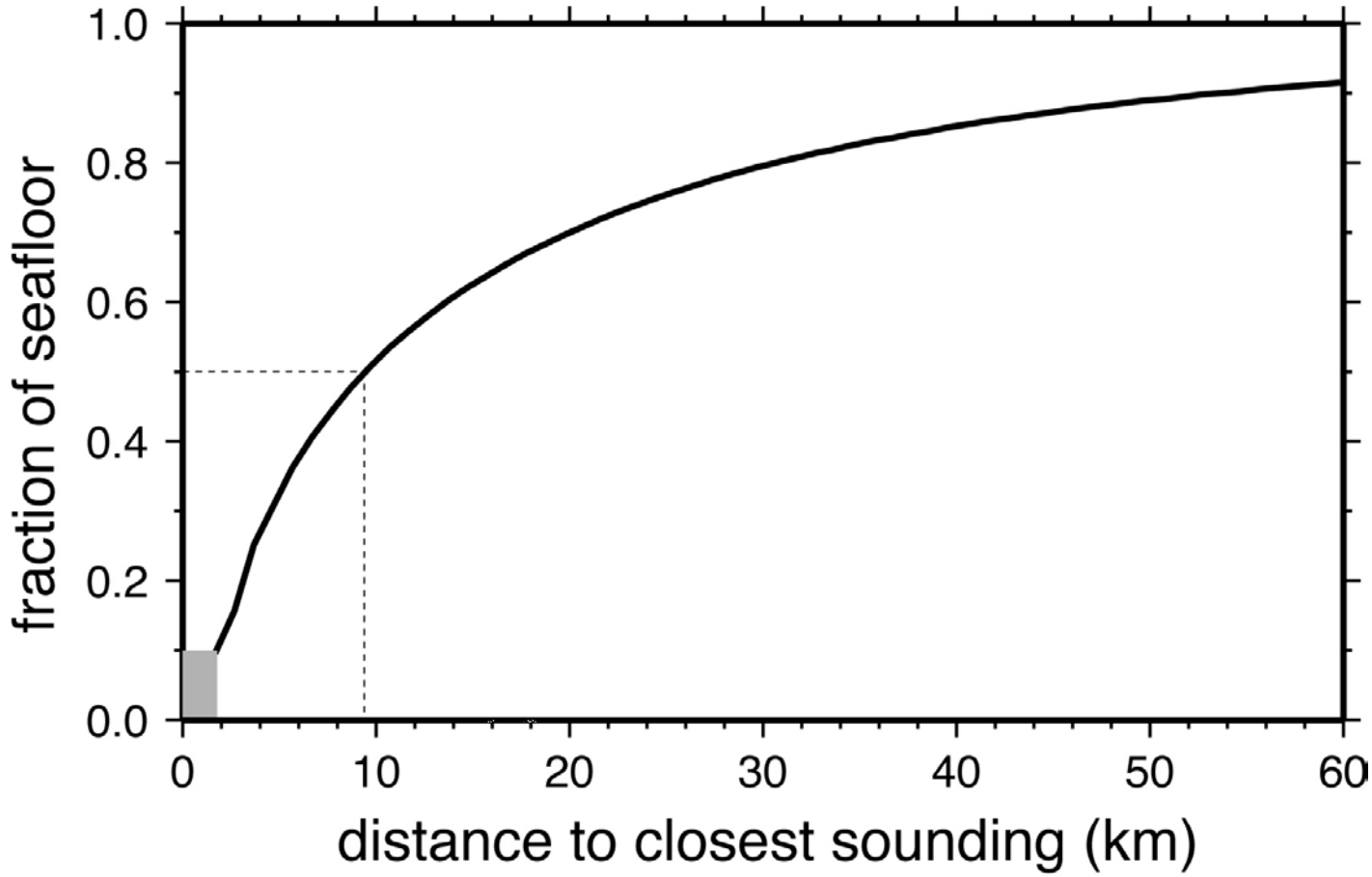

Google Earth
N
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
61 km
Google earth
lat -33.076273° lon -120.966898° elev -3506 m
Eye alt 250.29 km

SRTM30_PLUS & sounding coverage



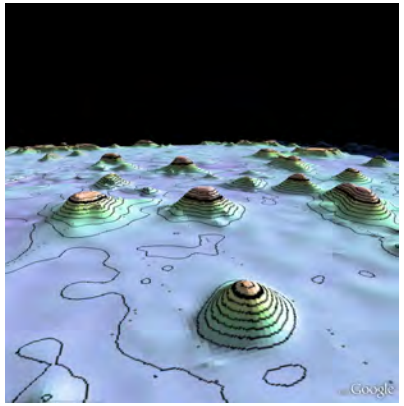

Data Sources
multi-beam soundings
predicted from satellite gravity
single-beam soundings
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
61 km
Google earth
lat -33.076273° lon -120.966898° elev -3506 m
Eye alt 250.29 km

1/2 of global seafloor bathymetry not resolved at 10 km resolution



[Smith and Marks, 2009]

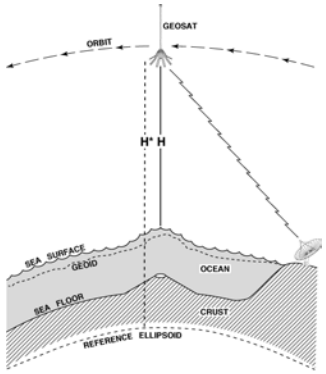
Sources of Depth Information



Source	% of Seafloor Mapped	% of Bad Data Found
CCOM	0.54	0
IBCAO	3.07	0
GEBCO	0.51	0.06
NAVO	0.07	0.07
NOAA	0.24	0.33
DNC	1.21	1.93
JAMSTEC	1.36	5.51
US MULTI	4.17	6.07
NGDC	6.70	10.98
MISC. GRIDS	6.06	28.95
IFREMER	0.30	31.24
NGA	0.44	35.65
3DGBR	0.11	39.34
Total	24.78	8.47

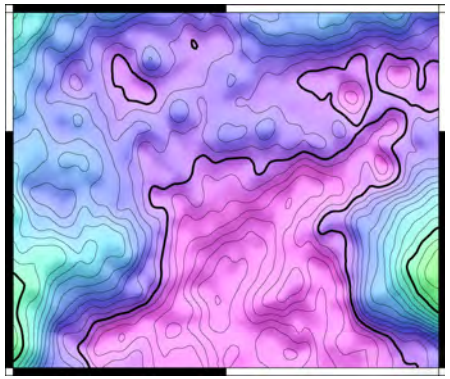
single-beam

75% of seafloor depth information comes from gravity



Towards 1 mGal Global Marine Gravity from CryoSat, Envisat, and Jason-1

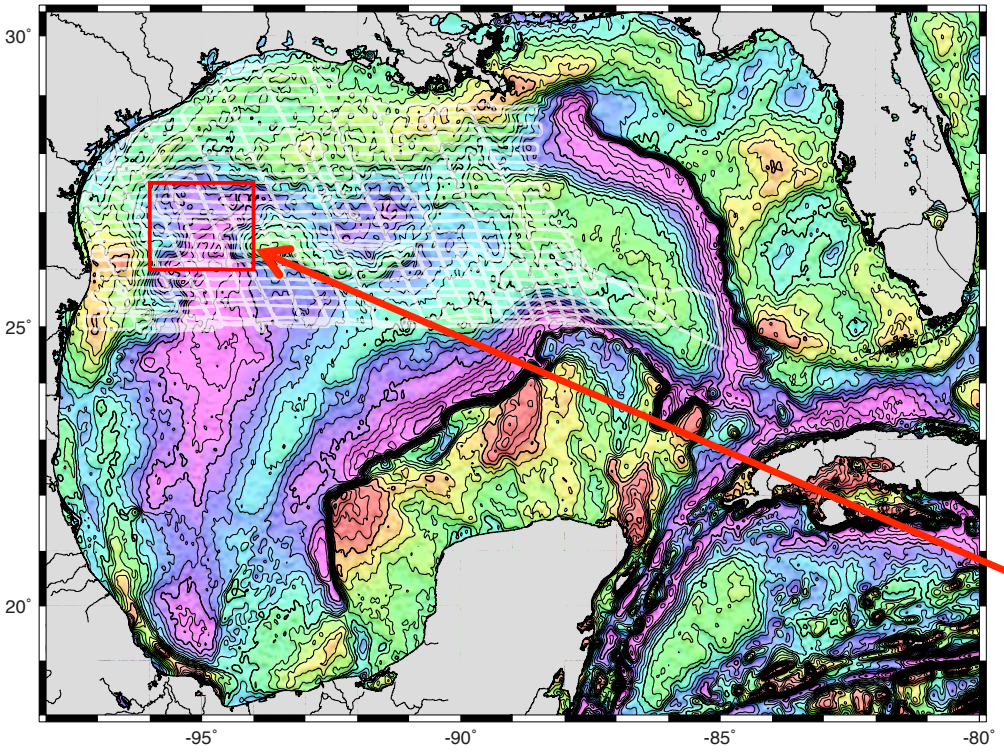
David Sandwell, Emmanuel Garcia, Kahlid Soofi,
Paul Wessel, and Walter H. F. Smith

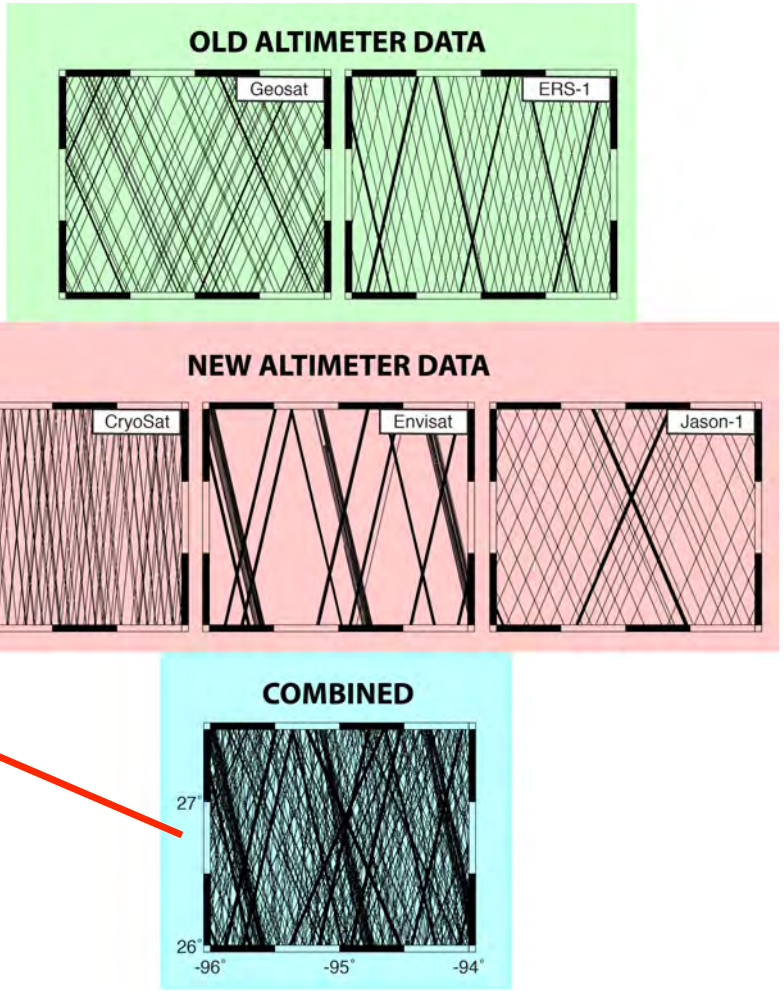


- higher accuracy = improved range precision + improved coverage
- retracking CryoSat, Envisat, and Jason-1 waveforms
- current gravity accuracy (V21.1 grid)
- contributions from Jason-1
- Is ship gravity from the academic fleet less accurate than satellite gravity?
- expected gravity improvements over the next 2 years

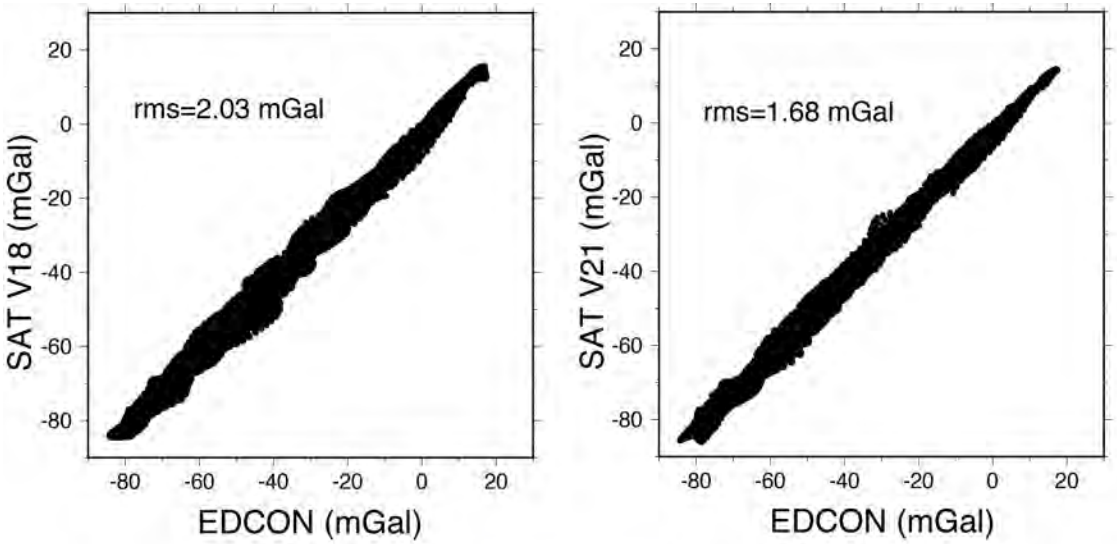
funding from: ConocoPhillips, NSF, and ONR

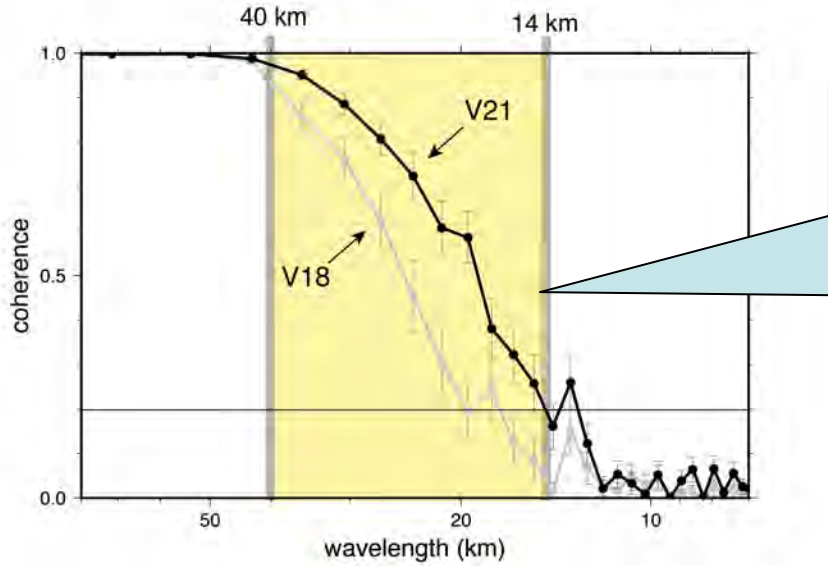
new altimeter coverage



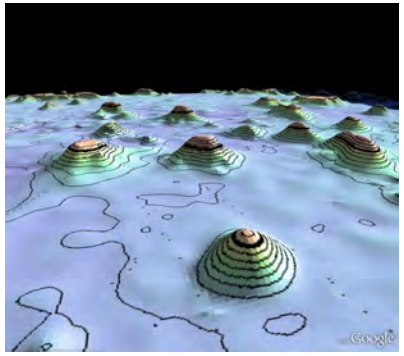


improved accuracy and resolution





Improved global gravity translates into improved global bathymetry for the 75% of the ocean that is uncharted. Best resolution is 7 km.



Proposed Tasks and Timeline

Tasks:

Create new 1-minute prediction based on new global gravity.

Update multibeam data from NGDC in global sounding database at 500 m.

Provide SRTM15_PLUS to GE in advance (6 mo.) of publication.

Work with Google researchers to provide open access to predictions and edited raw sounding data.

Timeline:

Deliver a preliminary SRTM30_PLUS in November of 2013 based on the full 409 days of Jason-1 altimetry and current sounding data.

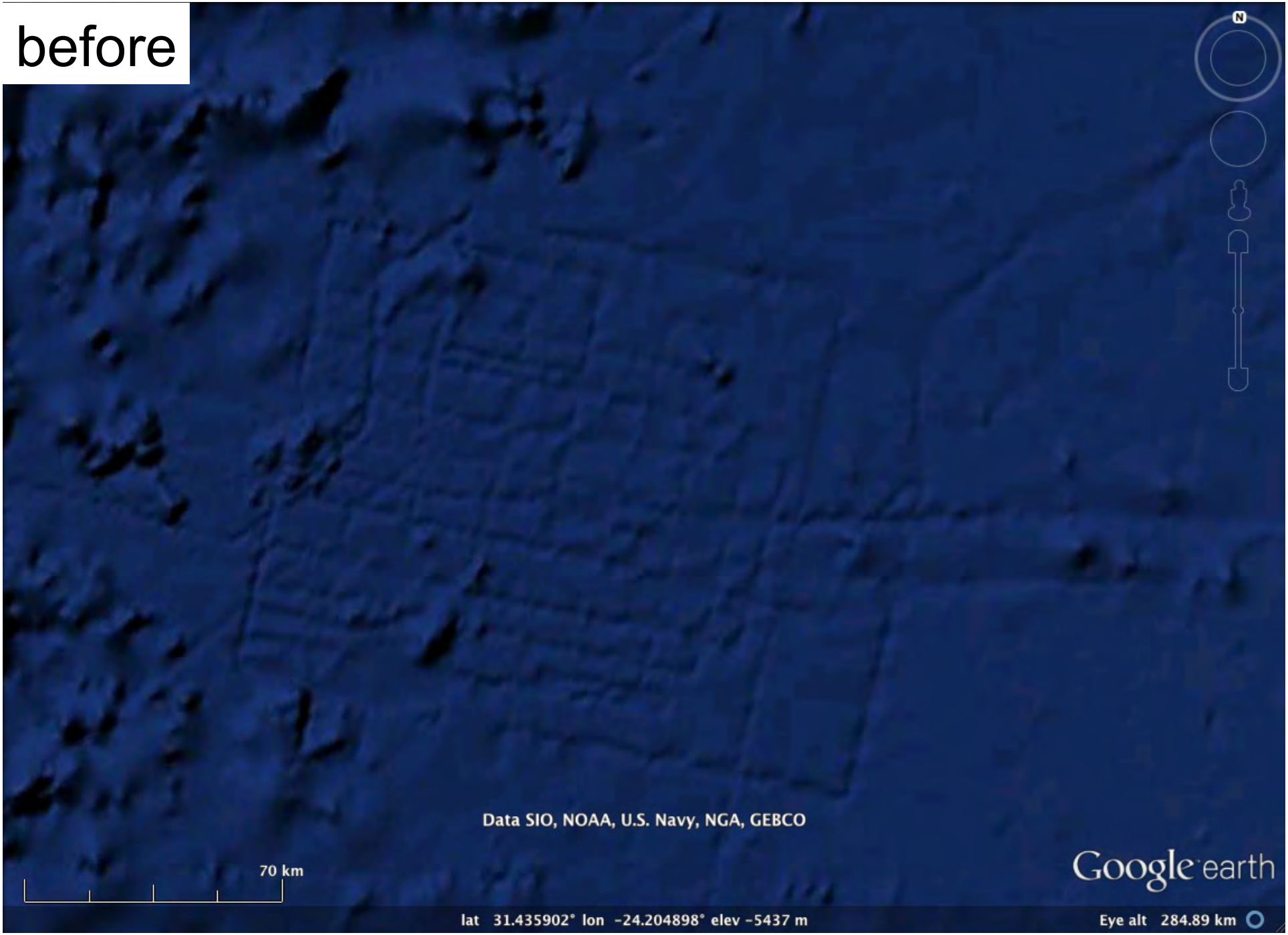
Update and edit global multibeam soundings using new data at NGDC. March 1, 2014.

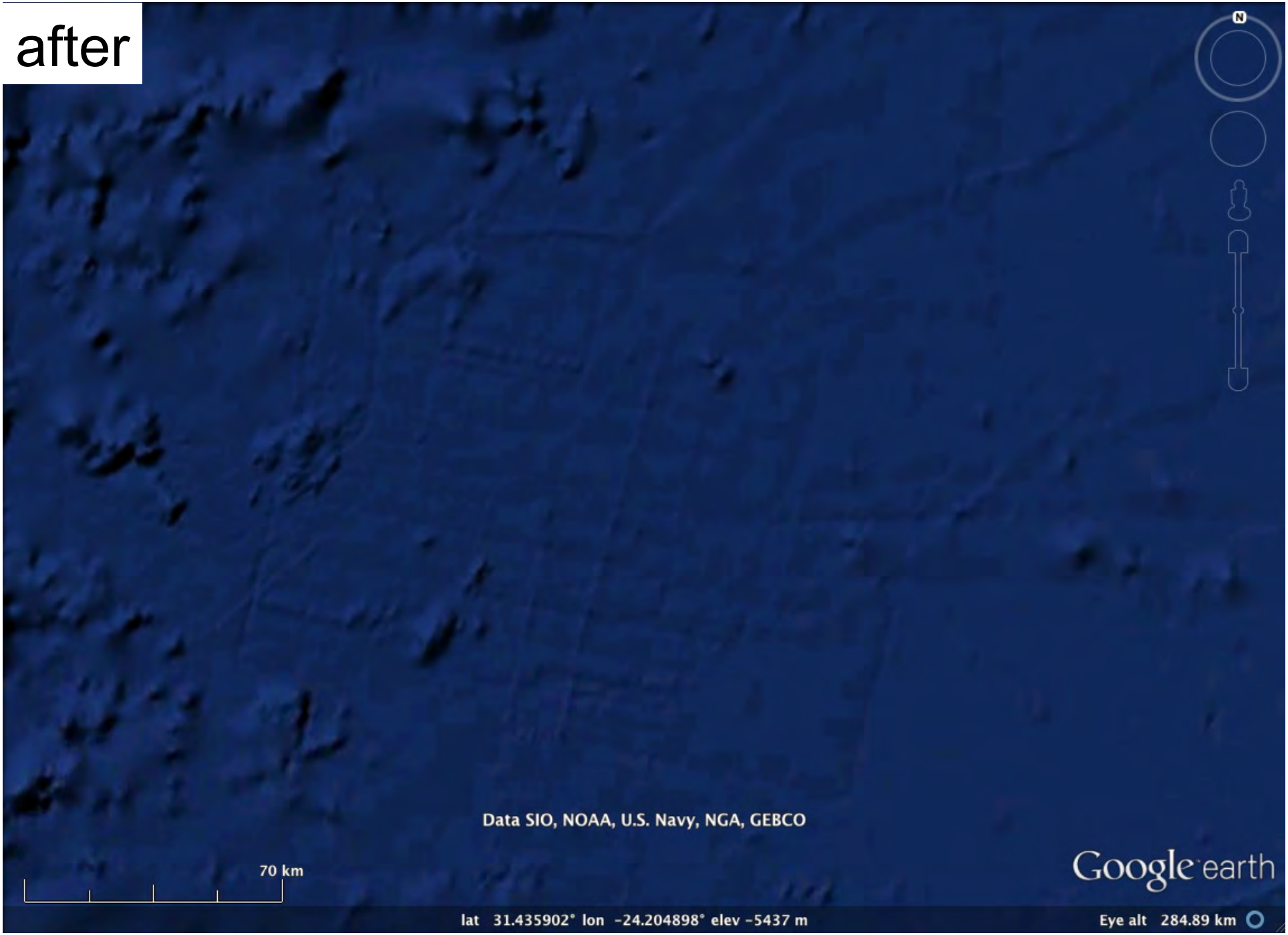
Work with GE researchers to validate and improve global shoreline.

Deliver new SRTM15 PLUS global bathymetry in September, 2014.

SIO Budget 9 months/yr postdoc for 3 years - $60k/yr.

NRL Budget 3m/yr for 3 years - $60k/yr


before
N
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
70 km
Google earth
lat 31.435902° lon -24.204898° elev -5437 m
Eye alt 284.89 km

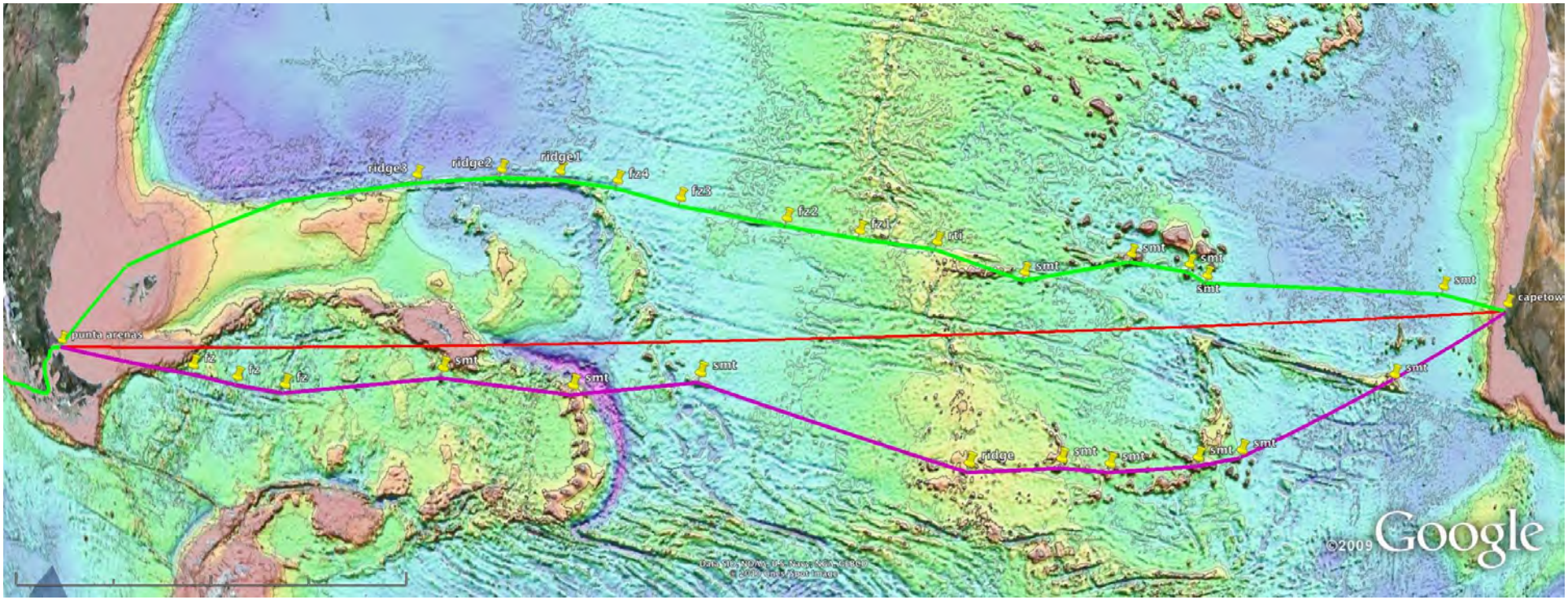

after
N
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
70 km
Google earth
lat 31.435902° lon -24.204898° elev -5437 m
Eye alt 284.89 km

How can we do better?

- Declassify US Navy bathymetry data.
- Launch a new satellite altimeter.
- Improve public archives of bathymetry.
- **Map the oceans with multibeam echosounders - ships of opportunity.**

Capetown to Punta Arenas - Melville - Feb, 2011

red - great circle = 6896 km
green - 10 new seamounts = 7130 km (1.034)
violet - 11 new seamounts = 7069 km (1.025)



Capetown to Punta Arenas - Melville - Mar 3, 2011