

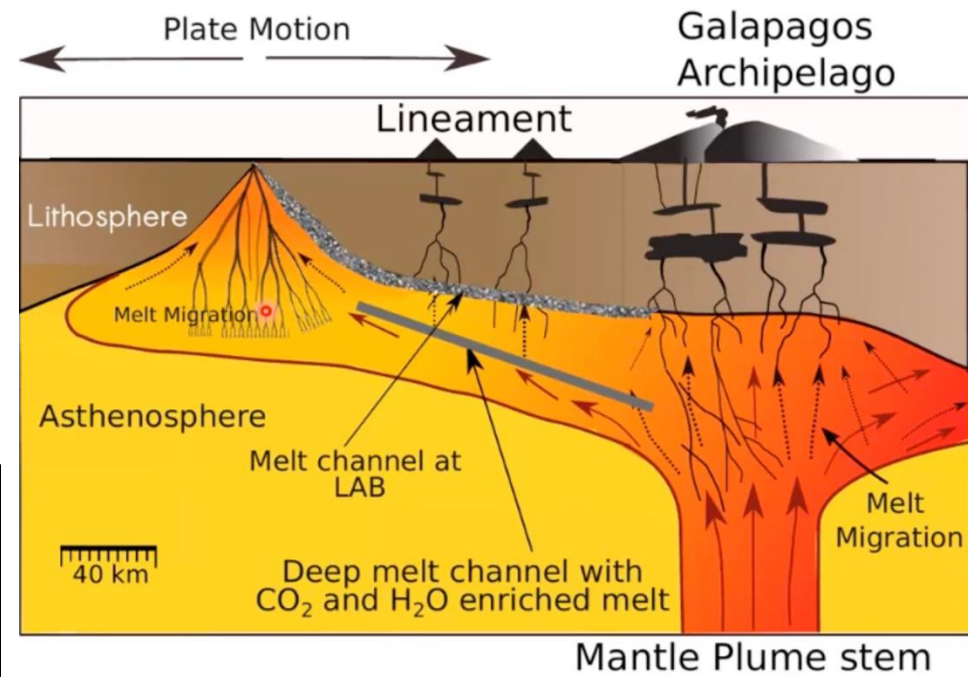
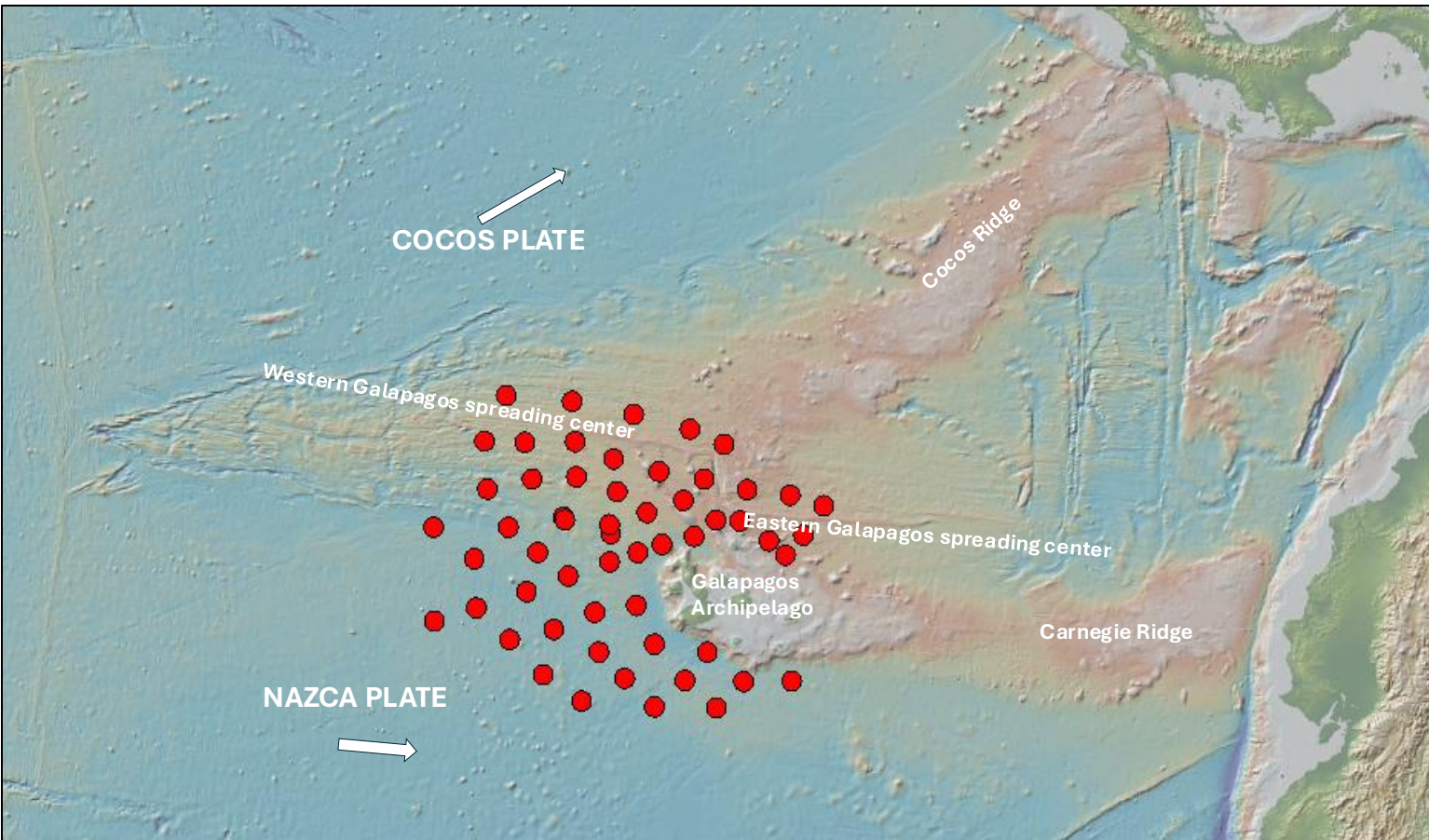


Marine IGUANA
***An Open Access Experiment to Image Galápagos
Plume-Ridge Interaction***

2024 MSROC Annual Meeting

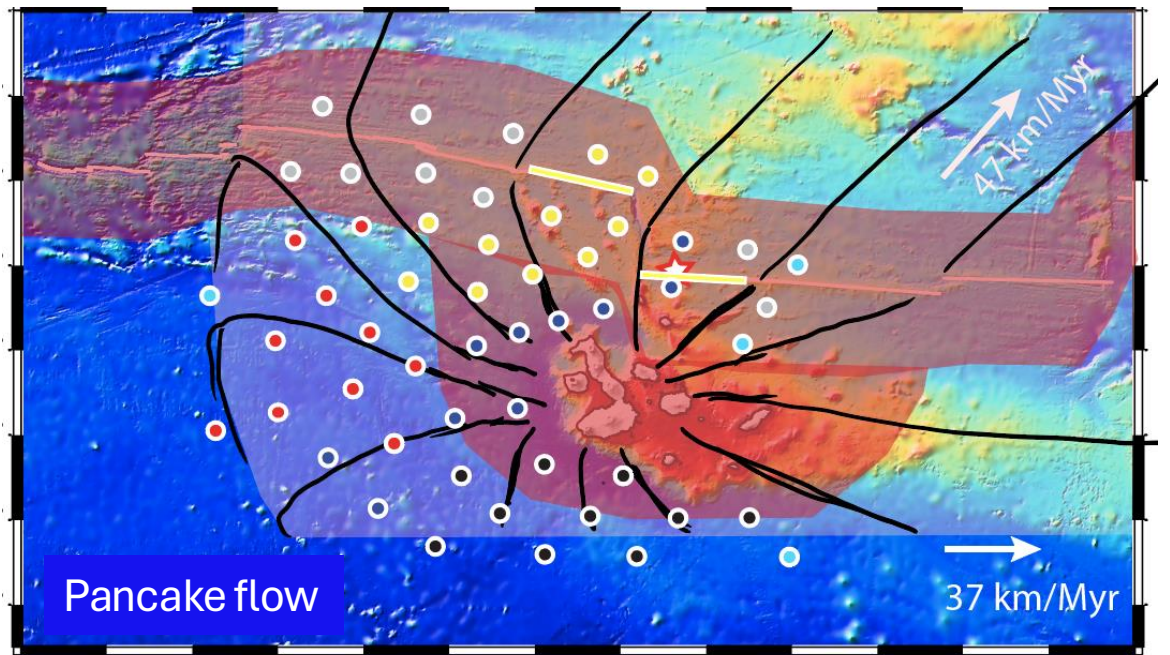
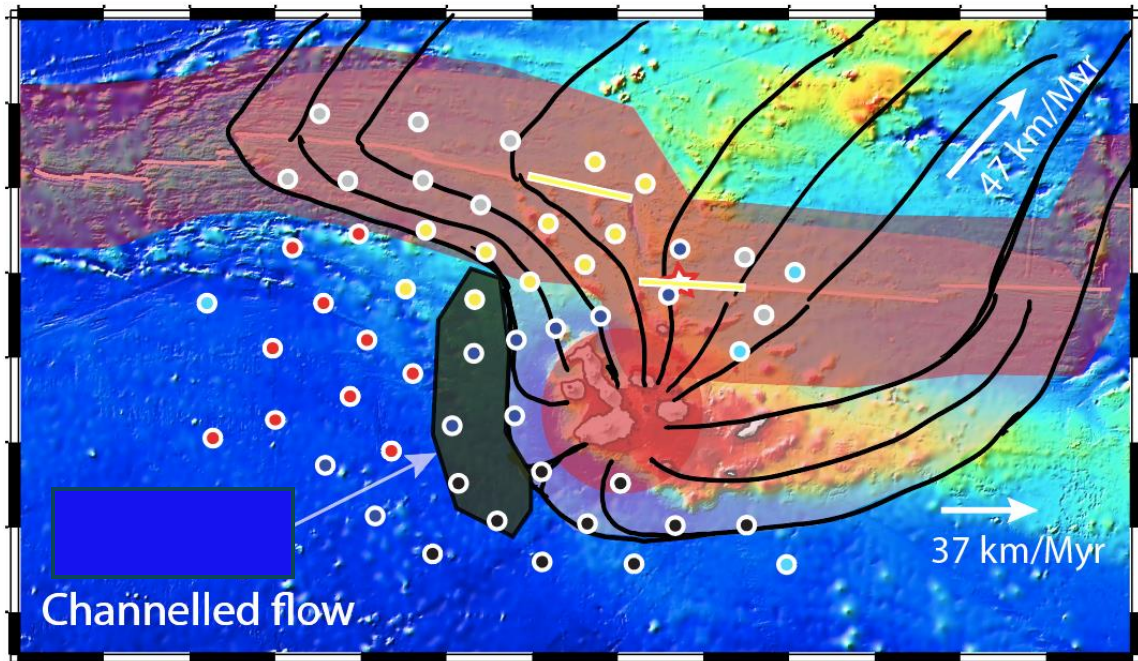
Emilie Hooft, Garrett Ito, Yang Shen, Doug Toomey, & Mario Ruiz

Galápagos Plume-Ridge Interaction



Science Goals:

- Find the thickness of the plume reservoir material from 50-300 km.
- Map lateral distribution of plume reservoir to distinguish channelled vs. plume flow.
- Investigate small-scale convection and heterogeneity in the mantle.



Science Goals:

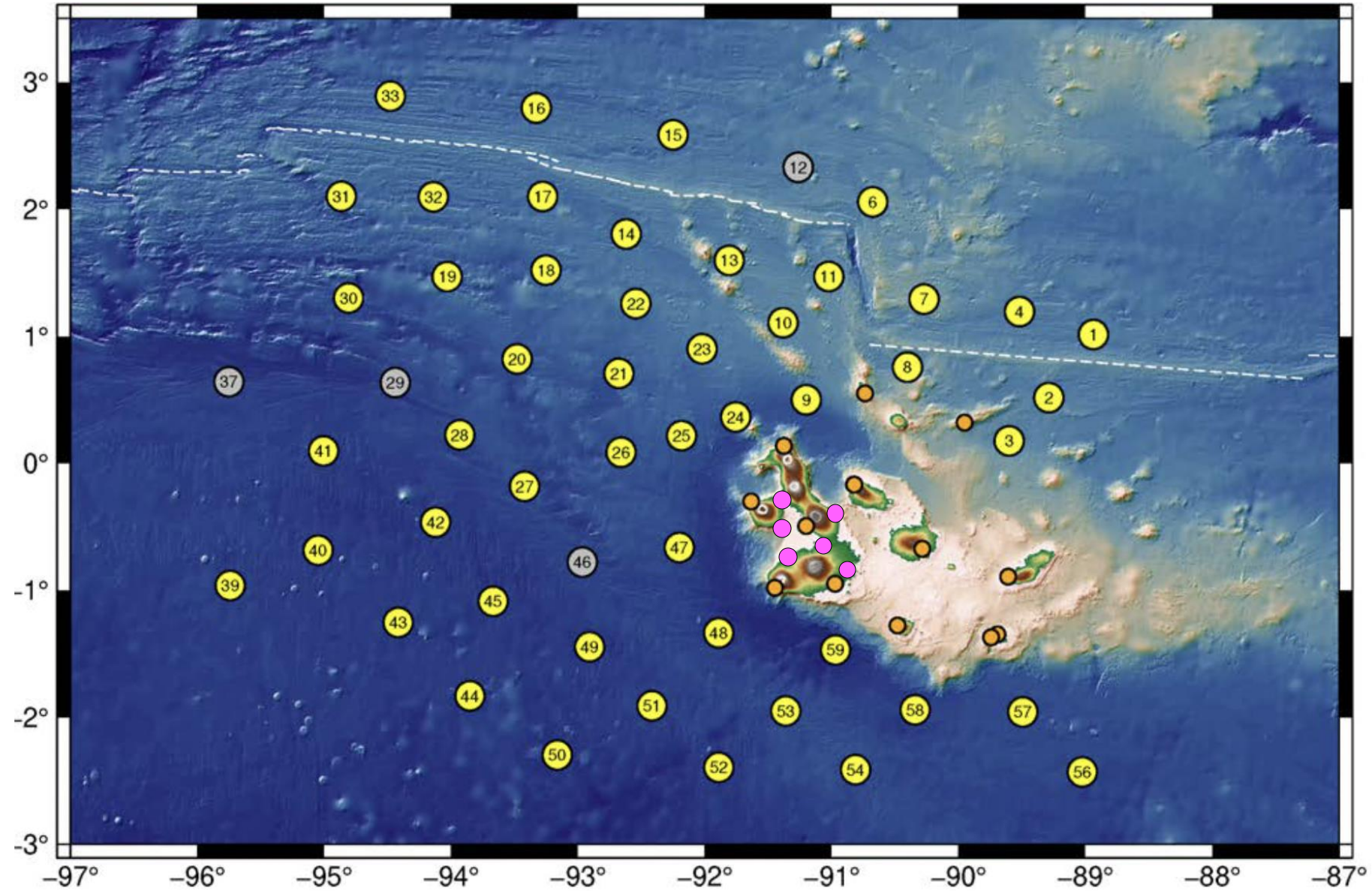
- Find the thickness of the plume reservoir material from 50-300 km.
- Map lateral distribution of plume reservoir to distinguish channeled vs. plume flow.
- Investigate small-scale convection and heterogeneity in the mantle.

Approaches:

- Designed to address the science goals: plume-ridge interaction
- Teleseismic & surface wave imaging including anisotropy
- Shear-wave splitting
- Receiver functions

OBS Array

- 53 broadband OBS deployed for 15 months
- 1 GSN station PAYG
- 6 IG-EPN seismic monitoring stations
- 10 on-island IGUANA array: 1999-2003
- **Total: 70**



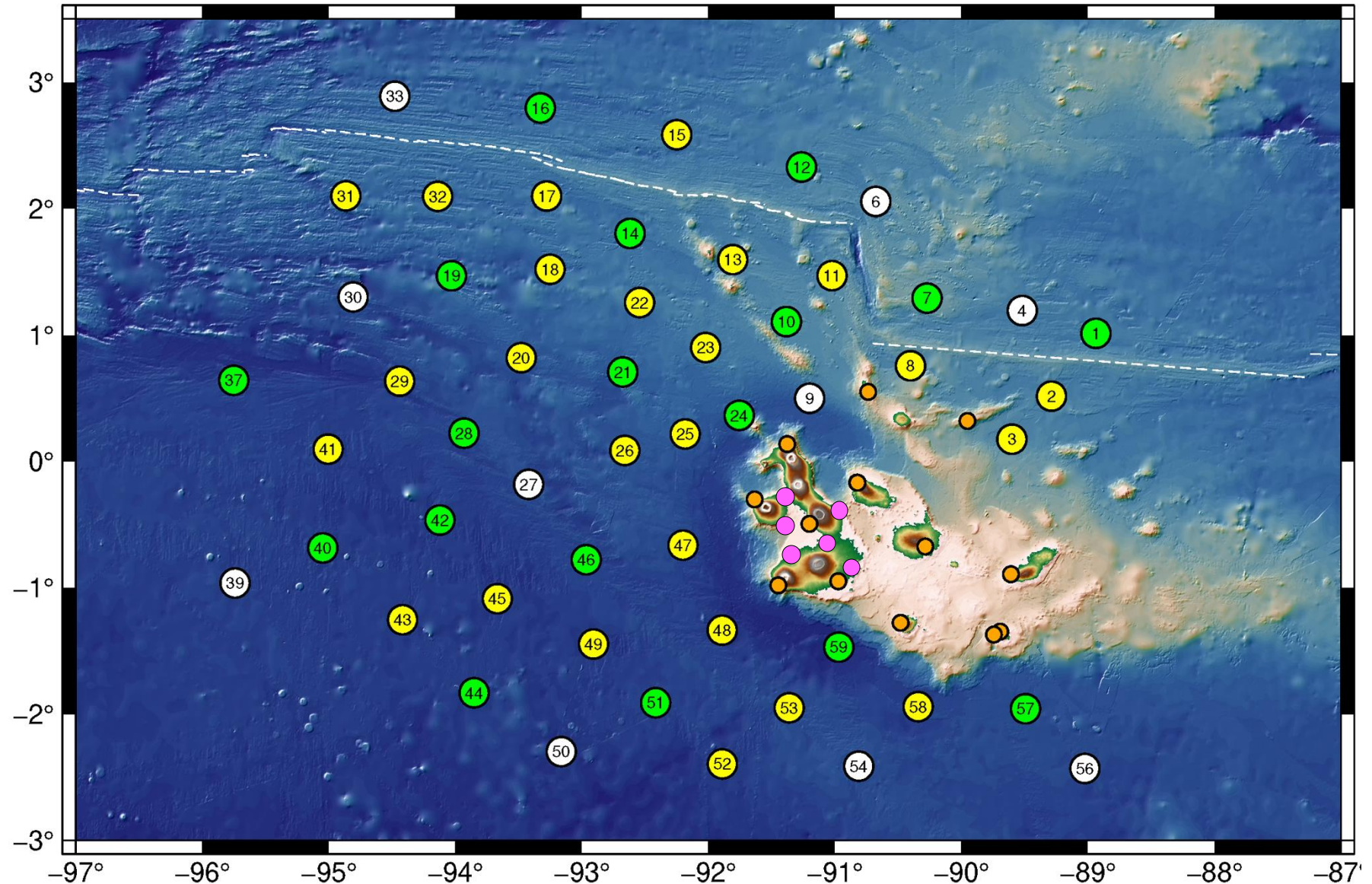
53 BB OBS

Three OBSIC
instrument types:

- T240 (10 white)
- Compact (18 green)
- Sphere (25 yellow)

Also:

- GSN PAYG (1 orange)
- IGUANA array (YH:
10 orange)
- 6 IG-EPN (pink)



This experiment: ocean bottom seismometers

10 new BB OBS
Angler: T240



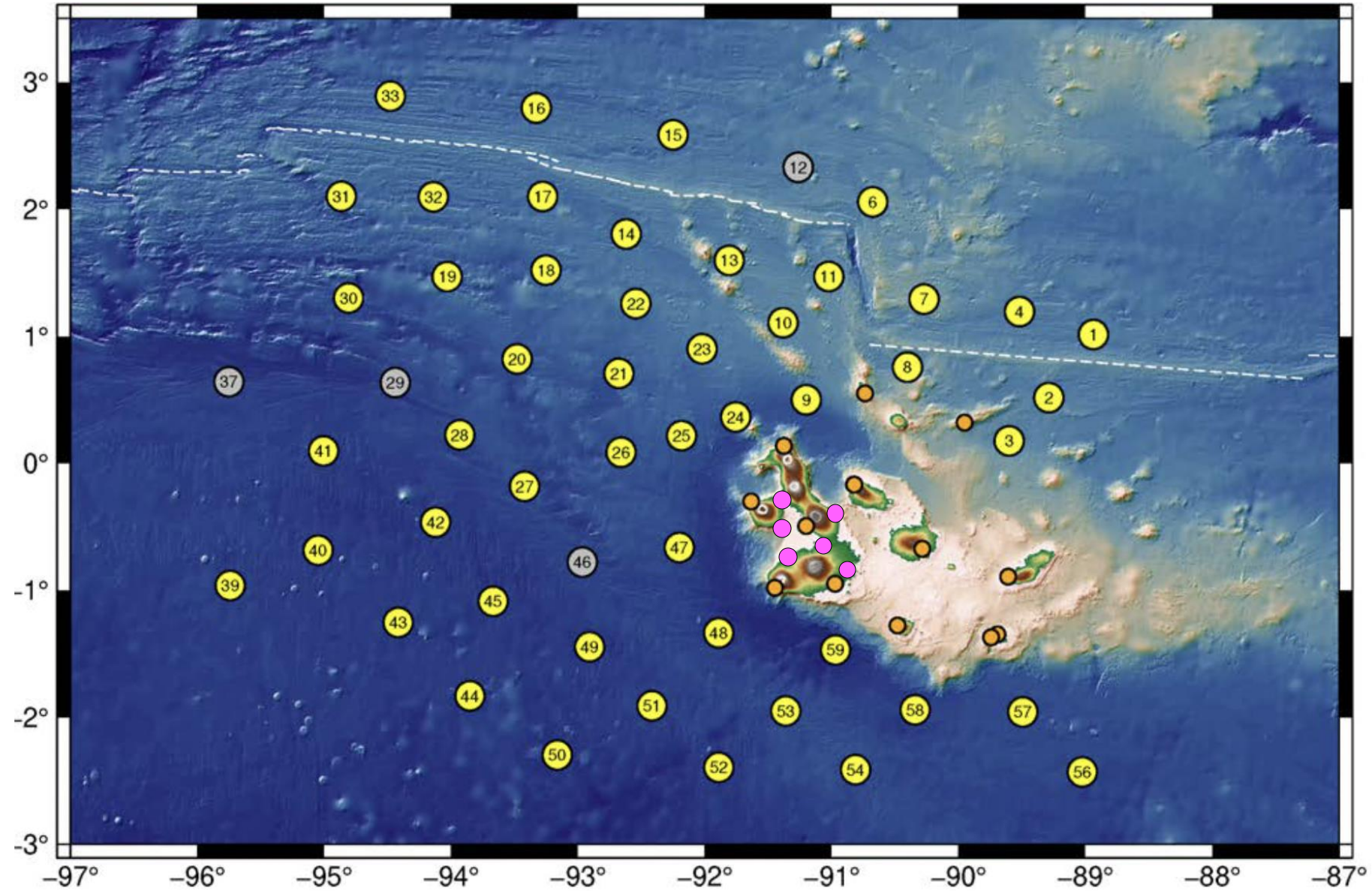
Compact: Trillium compact OBS

Sphere: Trillium compact



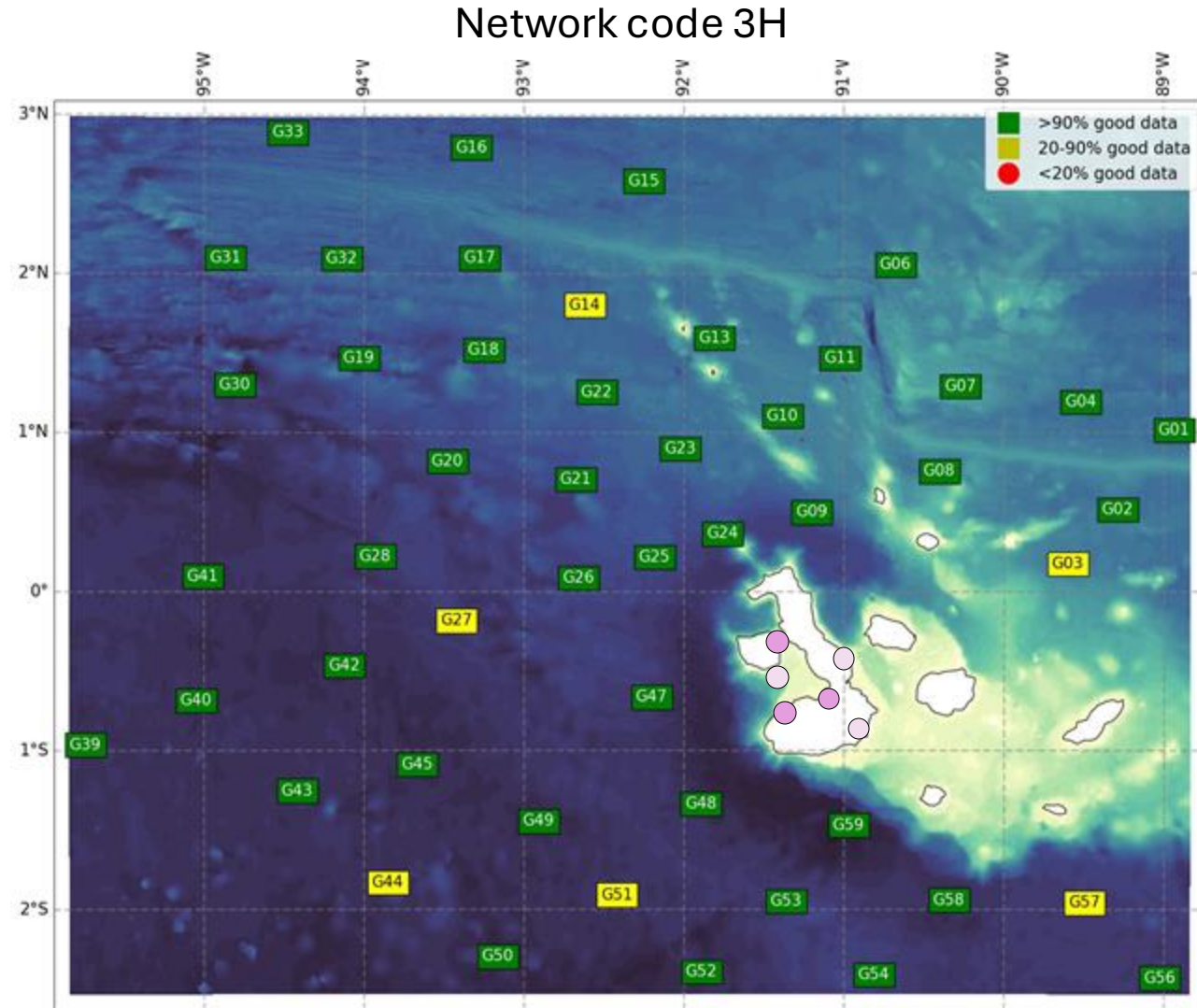
Recovery

- recovered 49 of 53 OBS
- a few issues with release mechanisms:
 - 3 were Compacts with single releases
 - Newer instruments have dual releases
- OBS showed robust performance



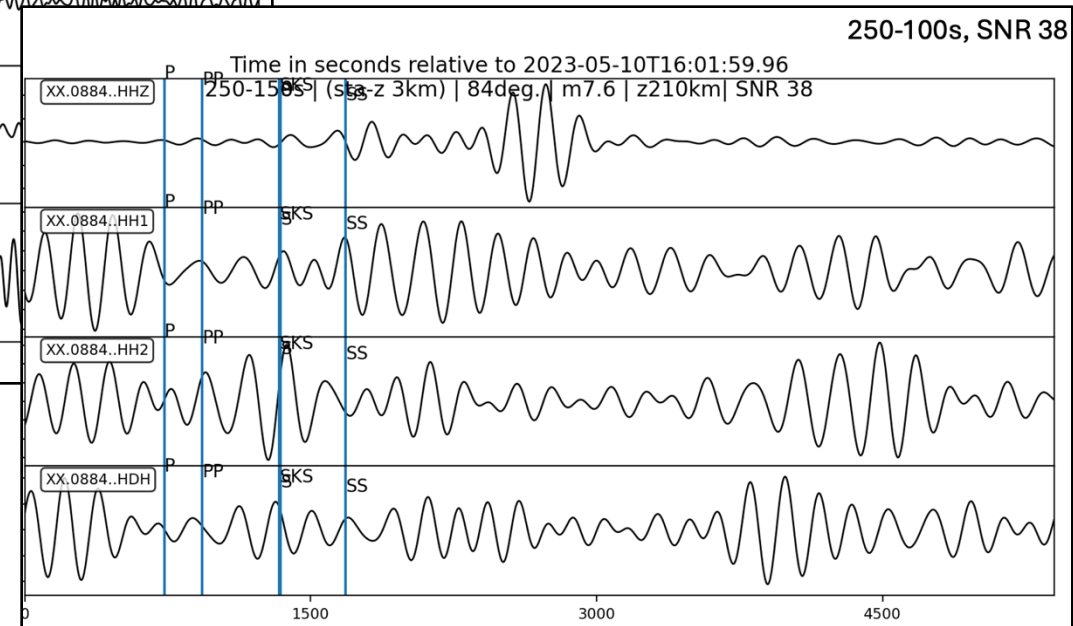
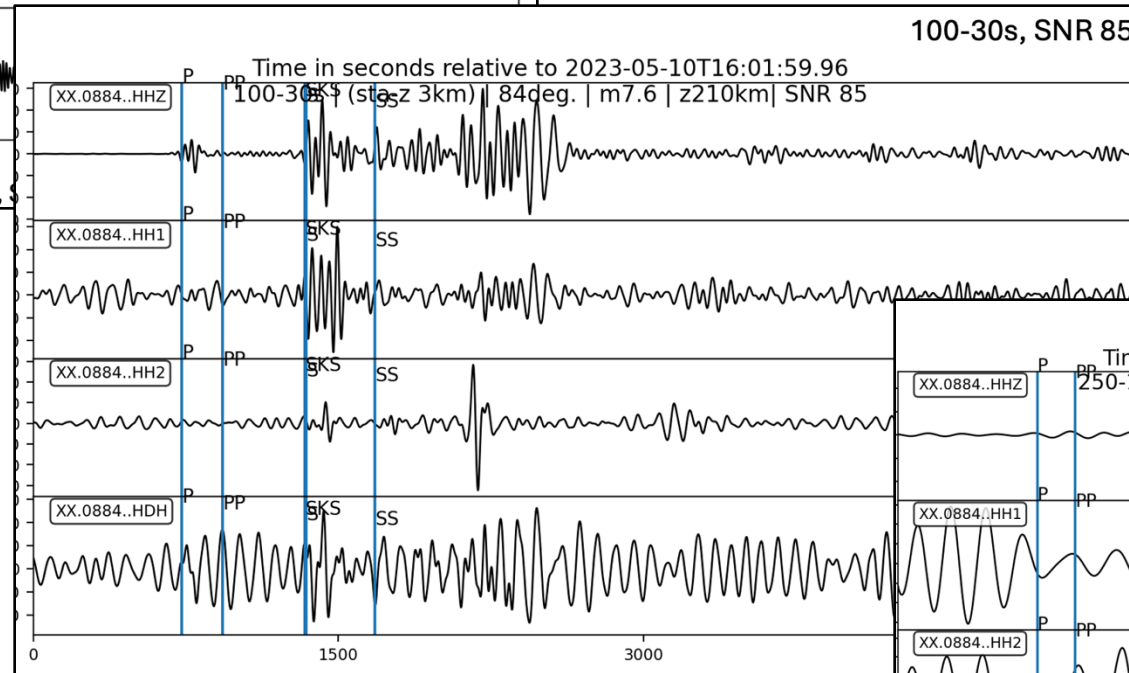
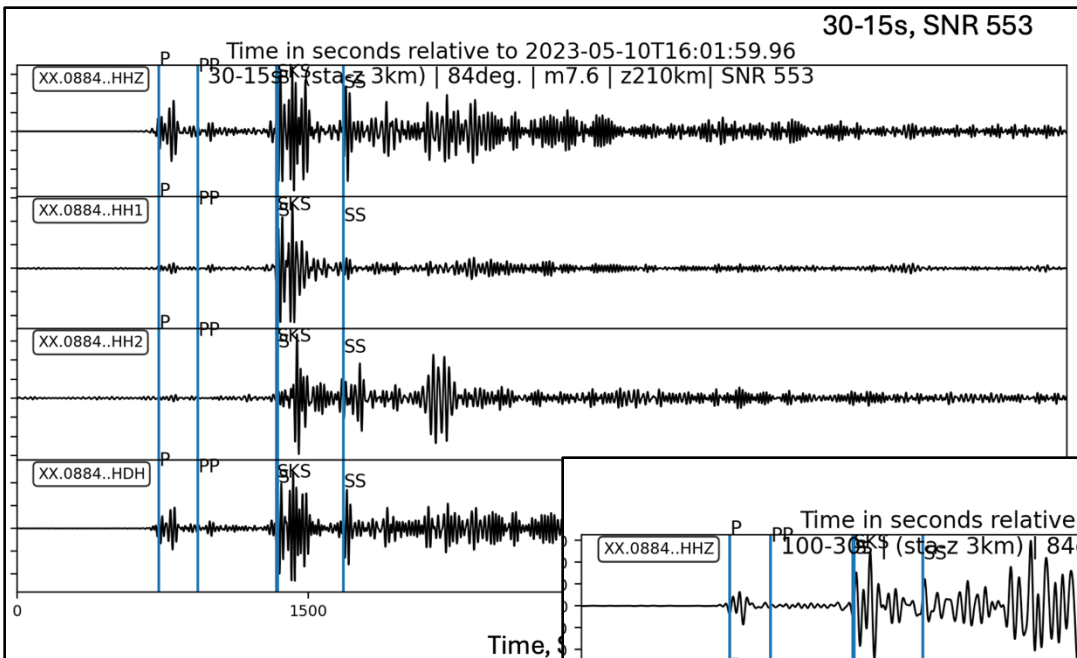
Preliminary Data Insights

- High SNR for vertical components
- Moderate noise for horizontal components; affected by bottom currents
- OBSIC data metrics: 6 with poor hydrophone channels

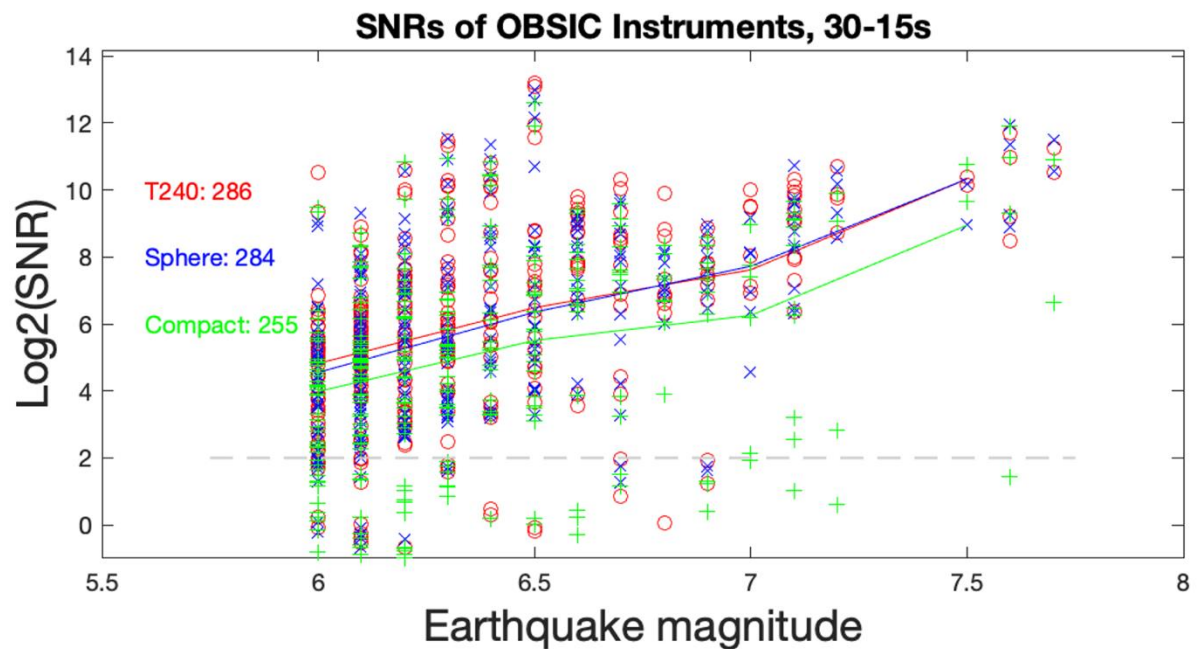
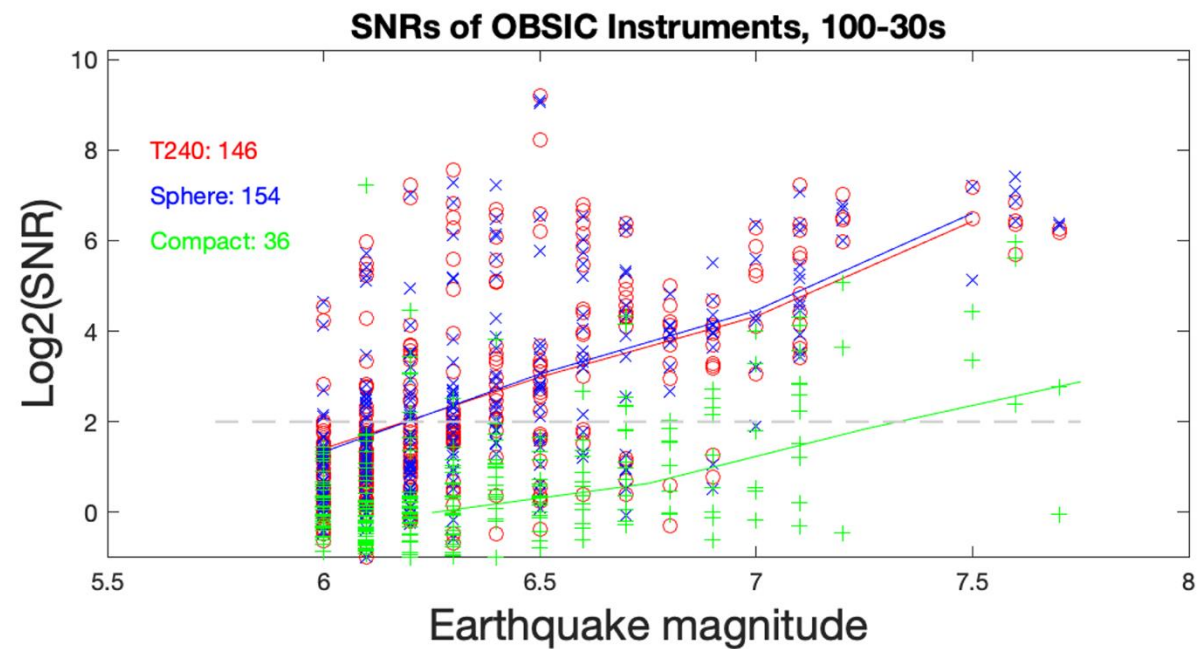
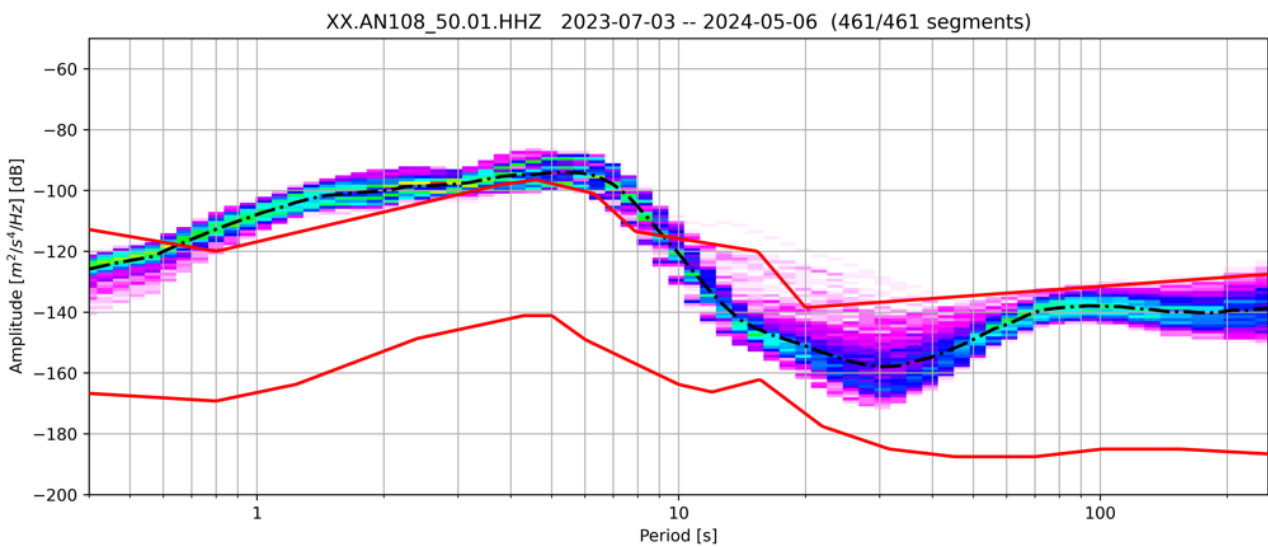


Vertical components

Teleseismic waveforms in different frequency bands on OBS AN106-56 for a M7.6 earthquake at 210 km depth at 84°



New Angler T240 BB OBS performed well

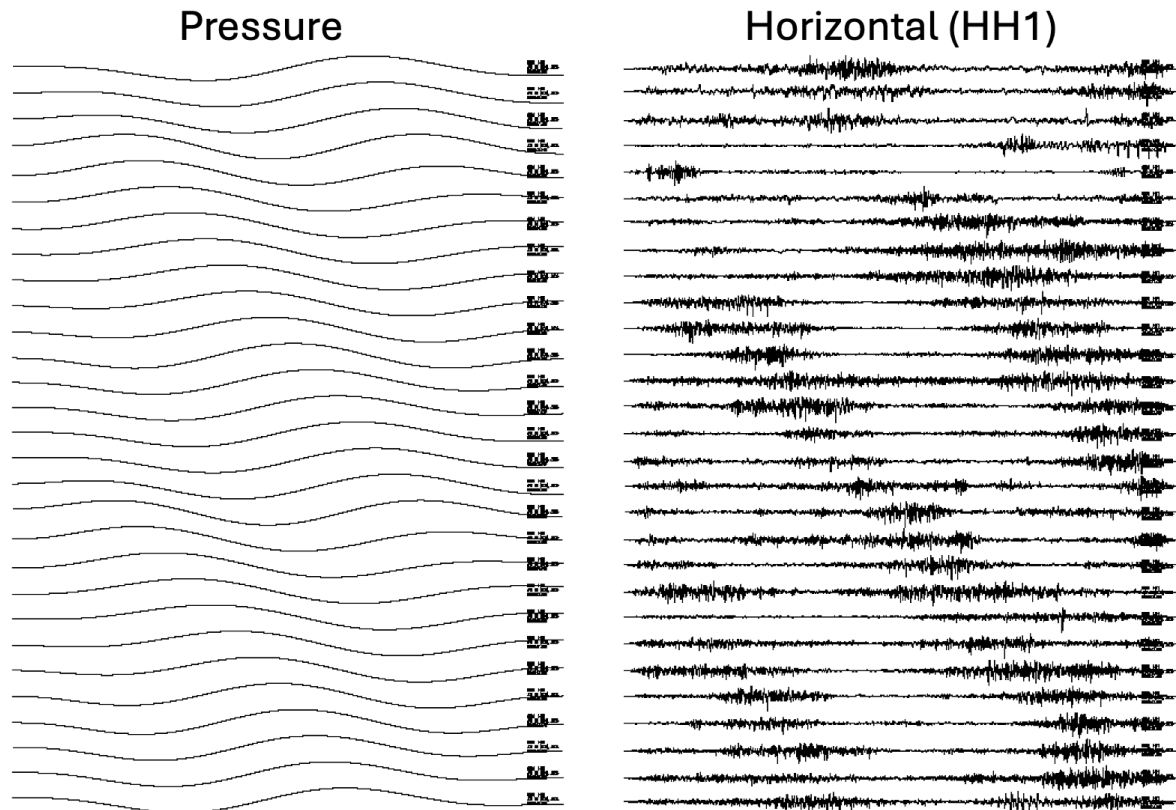


Horizontal components

Noise that is coincident with the pressure signal.

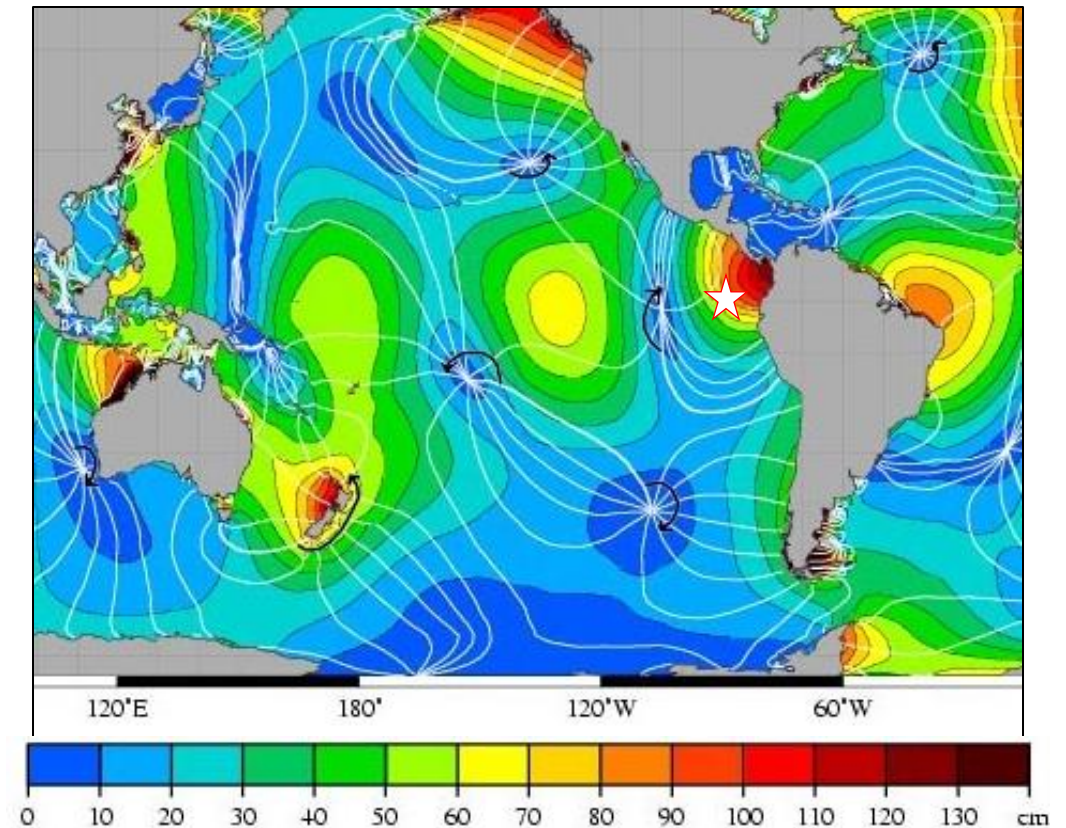
It has a tidal period. Hypothesis: Tidally driven bottom currents?

24 1-hour-long records from one day



AN106-56, 2024.001-029

Amplitude of M_2 tidal constituent

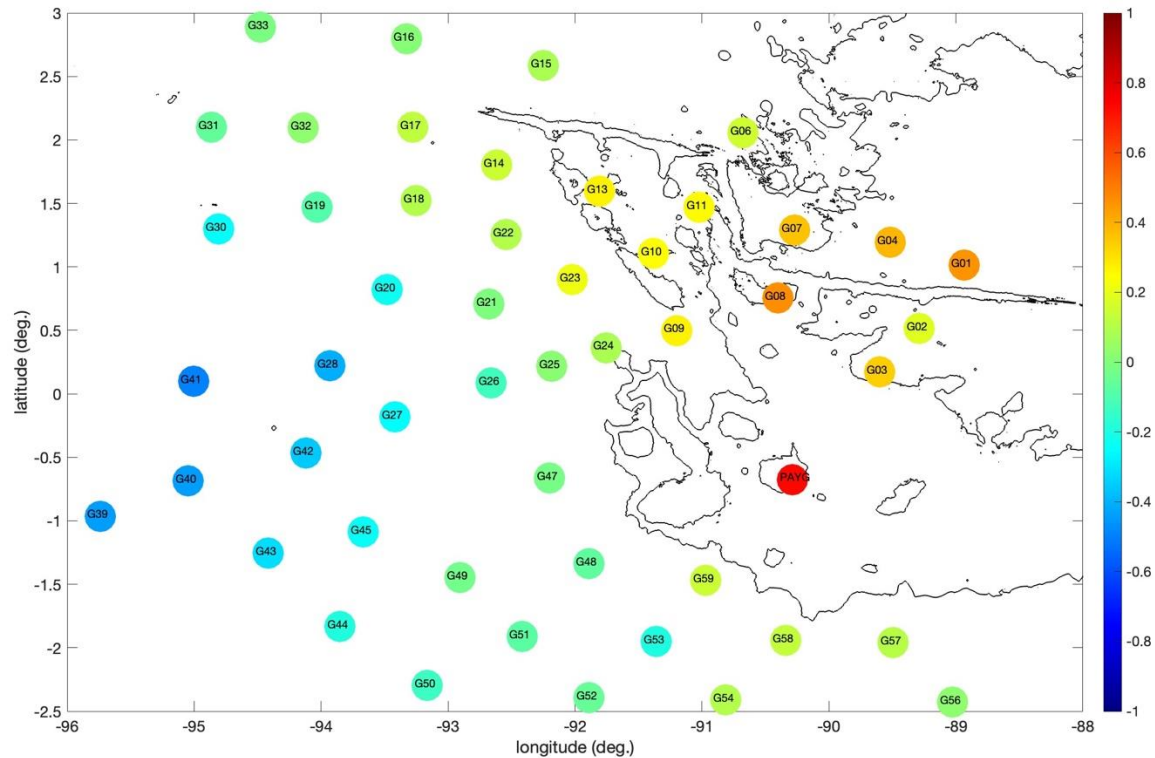


By R. Ray, NASA Goddard Space Flight Center, Jet Propulsion Laboratory, TOPEX/Poseidon: Revealing Hidden Tidal Energy.

AGU Presentations

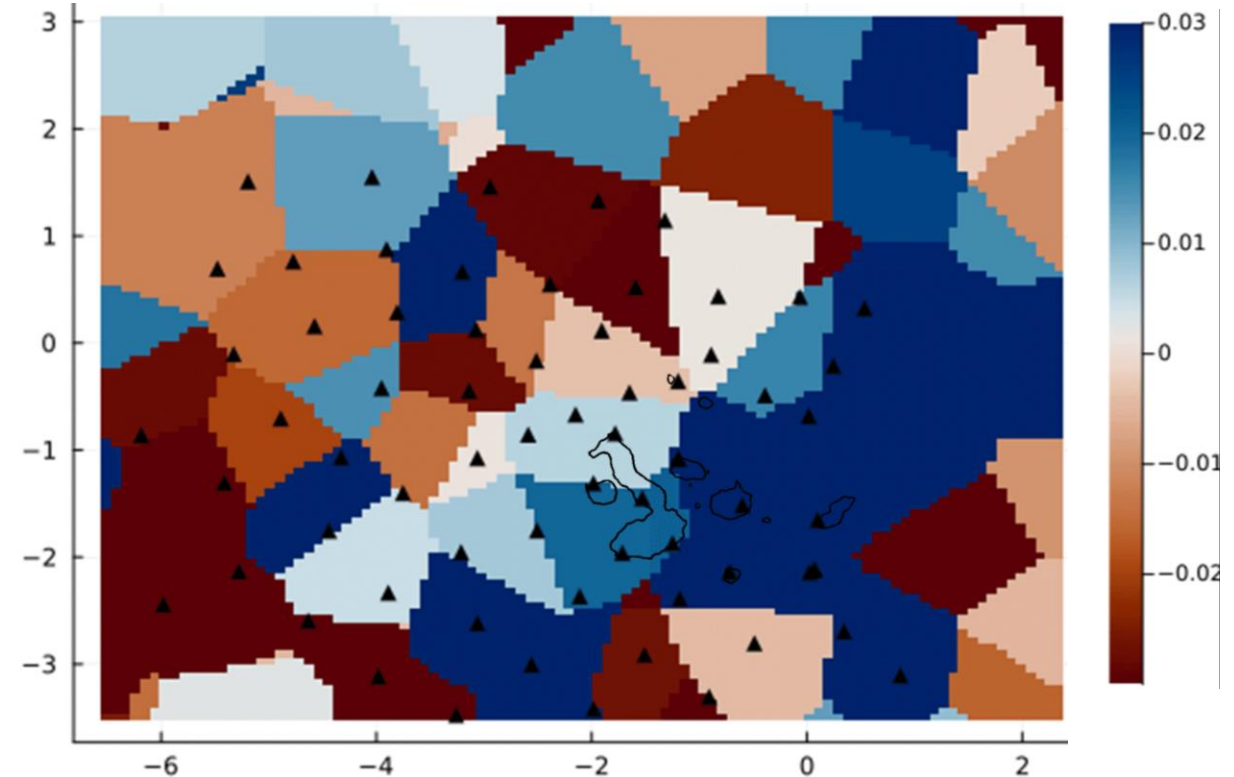
P-wave Anisotropic Velocity Model (V11F): Beck Hufstetler, et al.

Mean P-wave relative delay times:
93 teleseismic events



Anisotropic Mantle Imaging (V13G-05): Kaisa Autumn, et al.

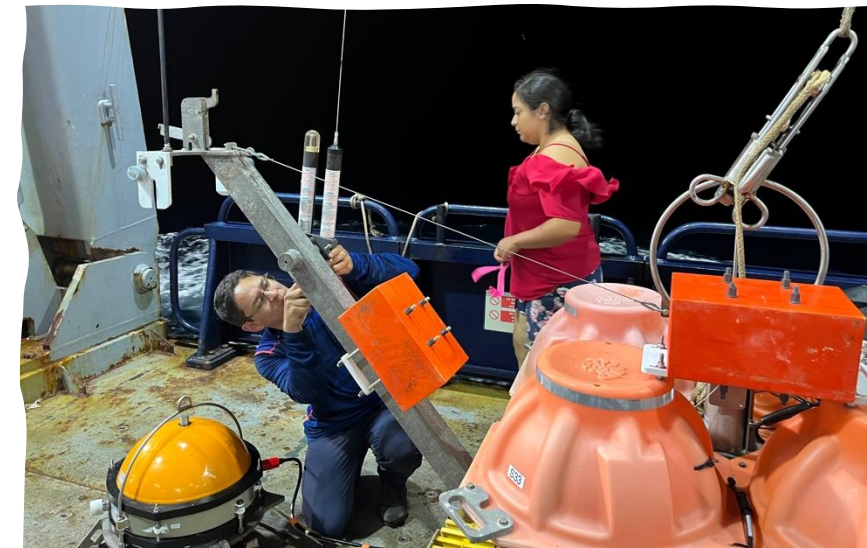
Bayesian inversion of synthetic seismic data
from geodynamic models



Evolution of one of 46 Monte Carlo chains

International & Regional Partnerships

- Collaborations with Ecuadorian & Costa Rican institutions, Charles Darwin Foundation Research Station, Galapagos National Park.
- Seafloor mapping, underway geophysics, characterization of upper water column, and biological & sediment sampling.
- Ongoing collaboration on seismic data analysis.



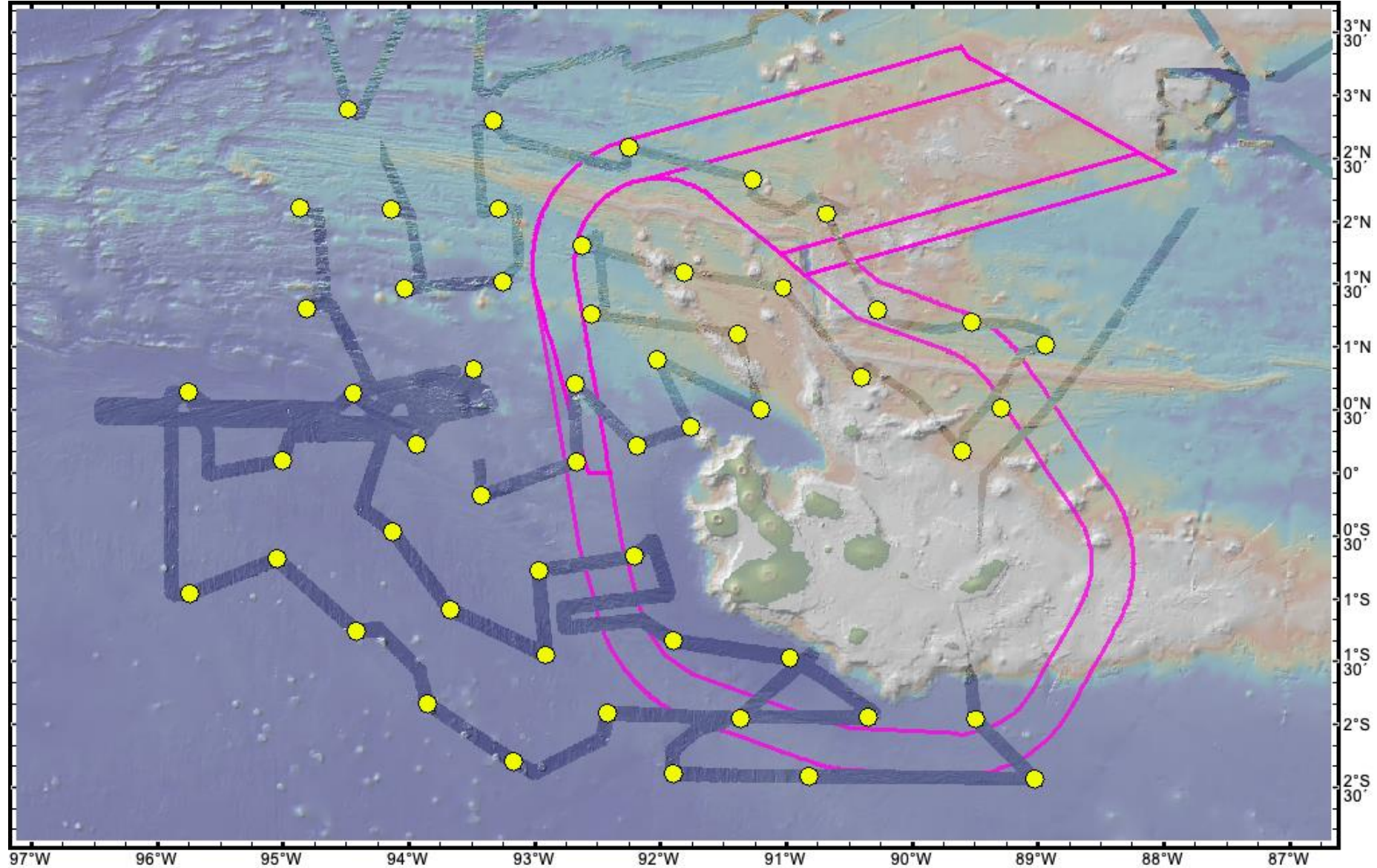


Charles Darwin Research Station

- colonization of the deep seafloor: 3700 - 1600m
- sediment distribution

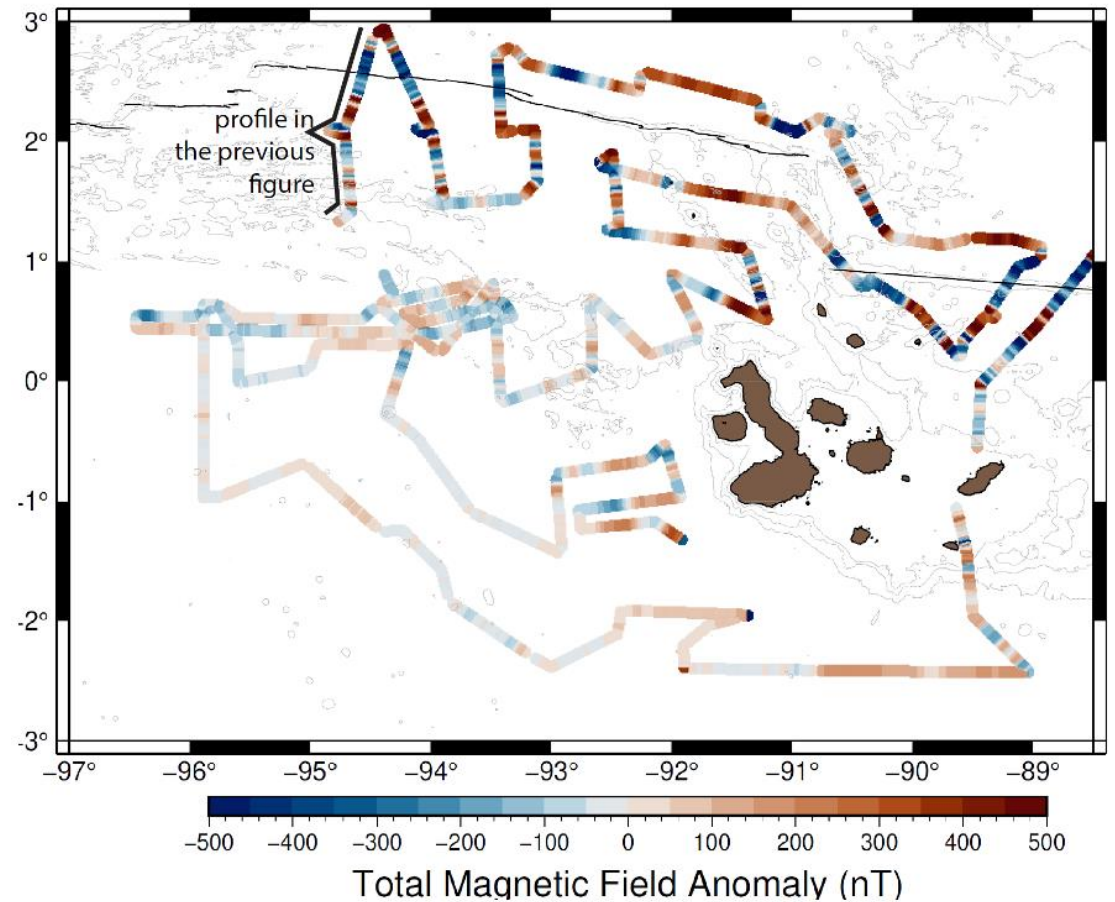
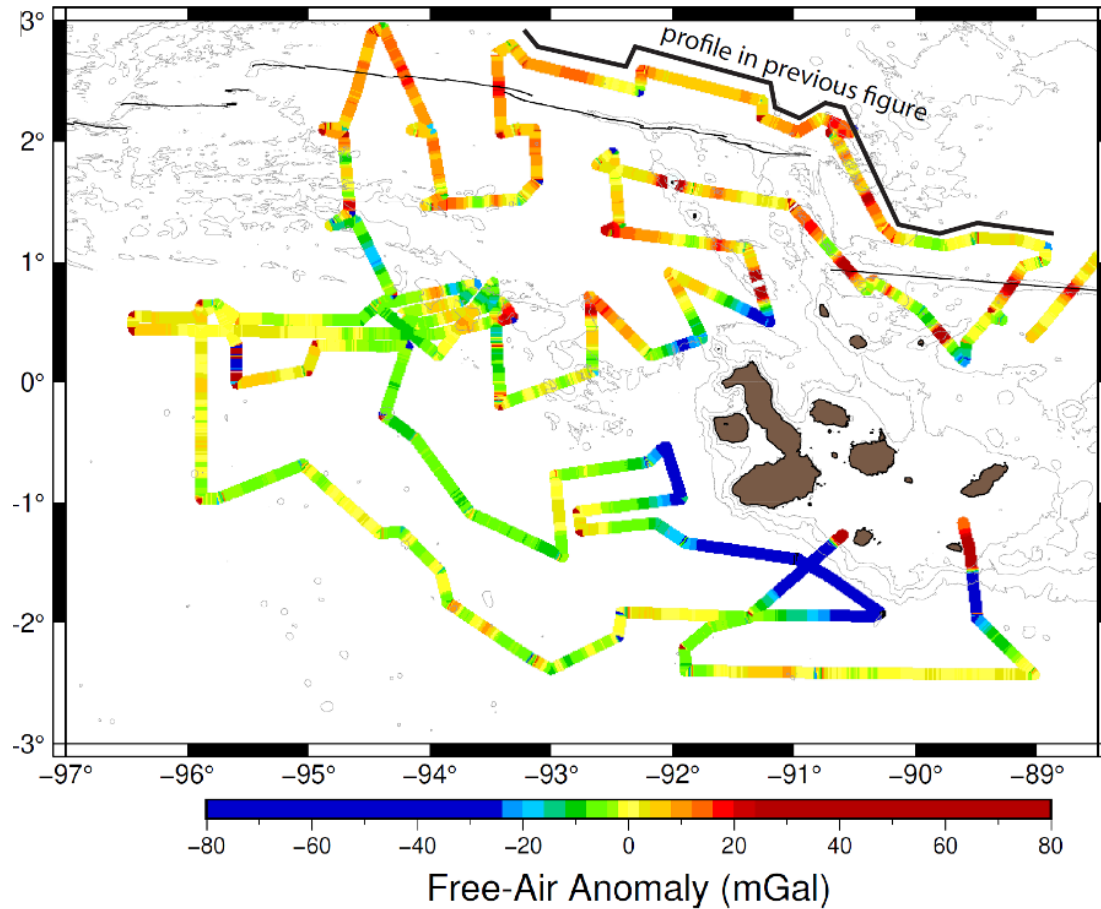
Seafloor Mapping

- Mapped unexplored regions south and west of the islands.
- Mapped ½ of Ecuador's new Hermandad marine reserve.
- Transit mapping on the Cocos Ridge.
- Data publicly available at R2R & GMRT



AGU Presentations

- *Volcanic History Using Gravity Data (V11F)*: Maddie Young, et al.



Marine IGUANA

A background map of the Pacific Ocean region, showing the western coast of North America and the Hawaiian Islands. The map is overlaid with numerous numbered circular markers in various colors (yellow, green, white) representing sampling sites. The numbers range from 1 to 58, distributed across the ocean basin.

Science Goals:

- Find the thickness of the plume reservoir material from 50-300 km.
- Map lateral distribution of plume reservoir and mantle flow.
- Investigate small-scale convection and heterogeneity in the mantle.
- Seismic data looks good

Approaches:

- International partnerships crucial to execution
- Contributions to nation's science goals & national interests
- Scientific collaborations longstanding & ongoing

A bathymetric map of the Galápagos Ridge, showing the seafloor topography in shades of blue, green, and brown. A cluster of red dots is overlaid on the ridge, indicating sampling locations. The text is overlaid on the lower portion of the map.

Marine IGUANA

***An Open Access Experiment to Image Galápagos
Plume-Ridge Interaction***

2024 MSROC Annual Meeting

Emilie Hooft, Garrett Ito, Yang Shen, Doug Toomey, & Mario Ruiz

Marine IGUANA

A background map of the Pacific Ocean region, showing the western coast of North America and the Hawaiian Islands. The map is overlaid with numerous numbered circular markers, representing sampling sites. The markers are color-coded: yellow (e.g., 2, 4, 6, 8, 9, 11, 13, 17, 18, 20, 22, 25, 26, 27, 29, 30, 31, 32, 39, 41, 43, 45, 47, 49, 50, 52, 53, 54, 56), green (e.g., 10, 12, 14, 16, 19, 21, 24, 42, 44, 46, 51, 55, 57, 59), and white (e.g., 3, 5, 7, 15, 23, 28, 33, 34, 35, 36, 37, 38, 40, 48, 58). The map also shows bathymetric contours and a dashed white line representing a geological boundary.

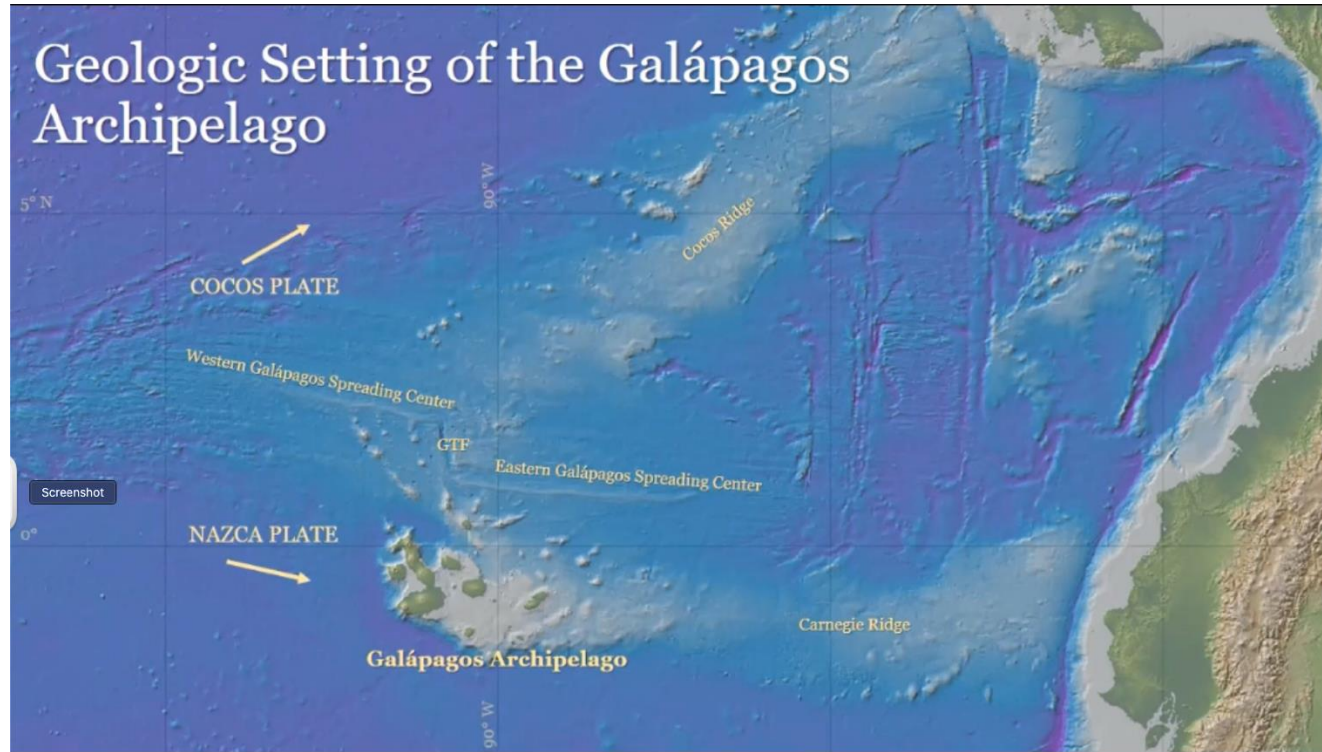
Science Goals:

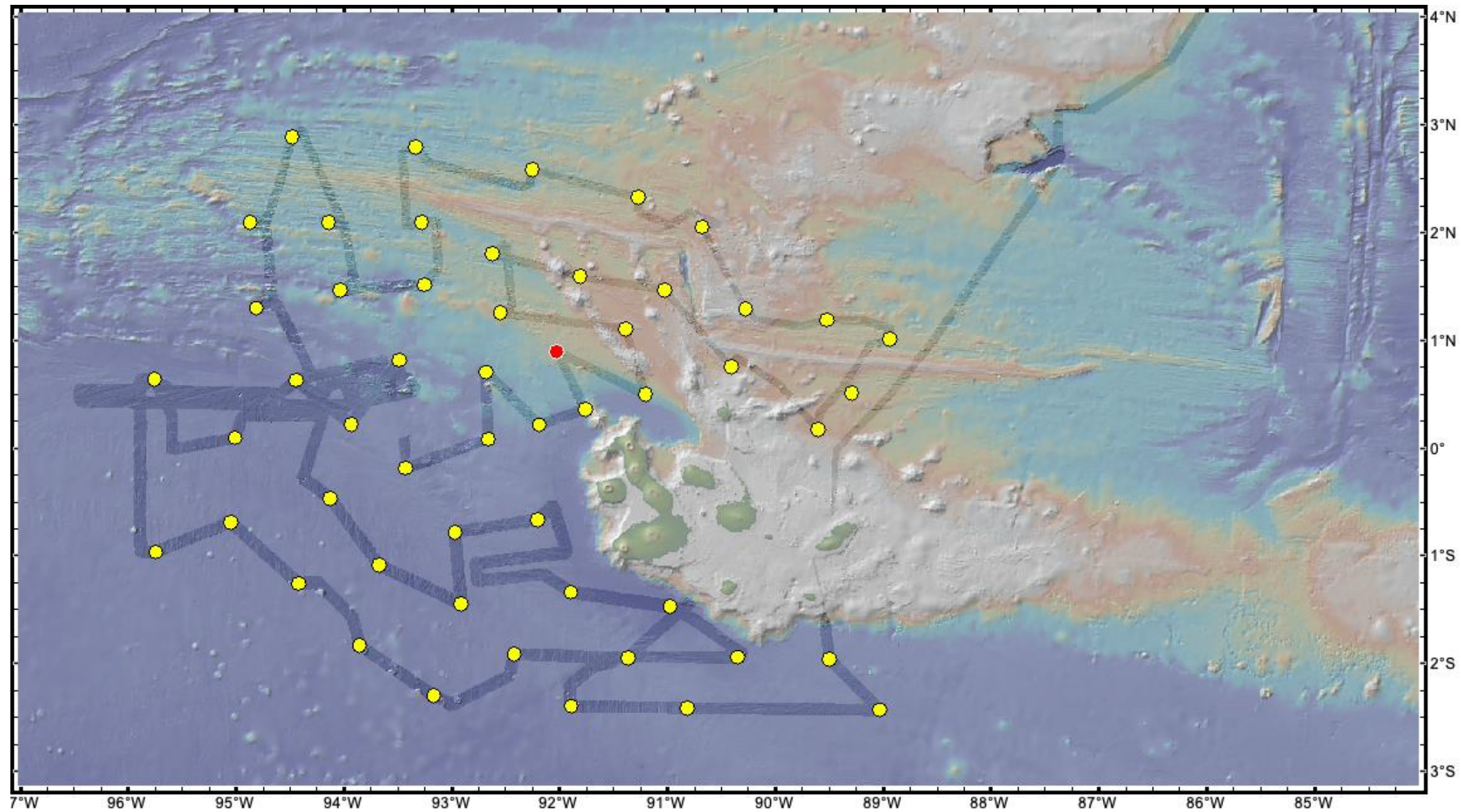
- Find the thickness of the plume reservoir material from 50-300 km.
- Map lateral distribution of plume reservoir to distinguish channeled vs. plume flow.
- Investigate small-scale convection and heterogeneity in the mantle.

Approaches:

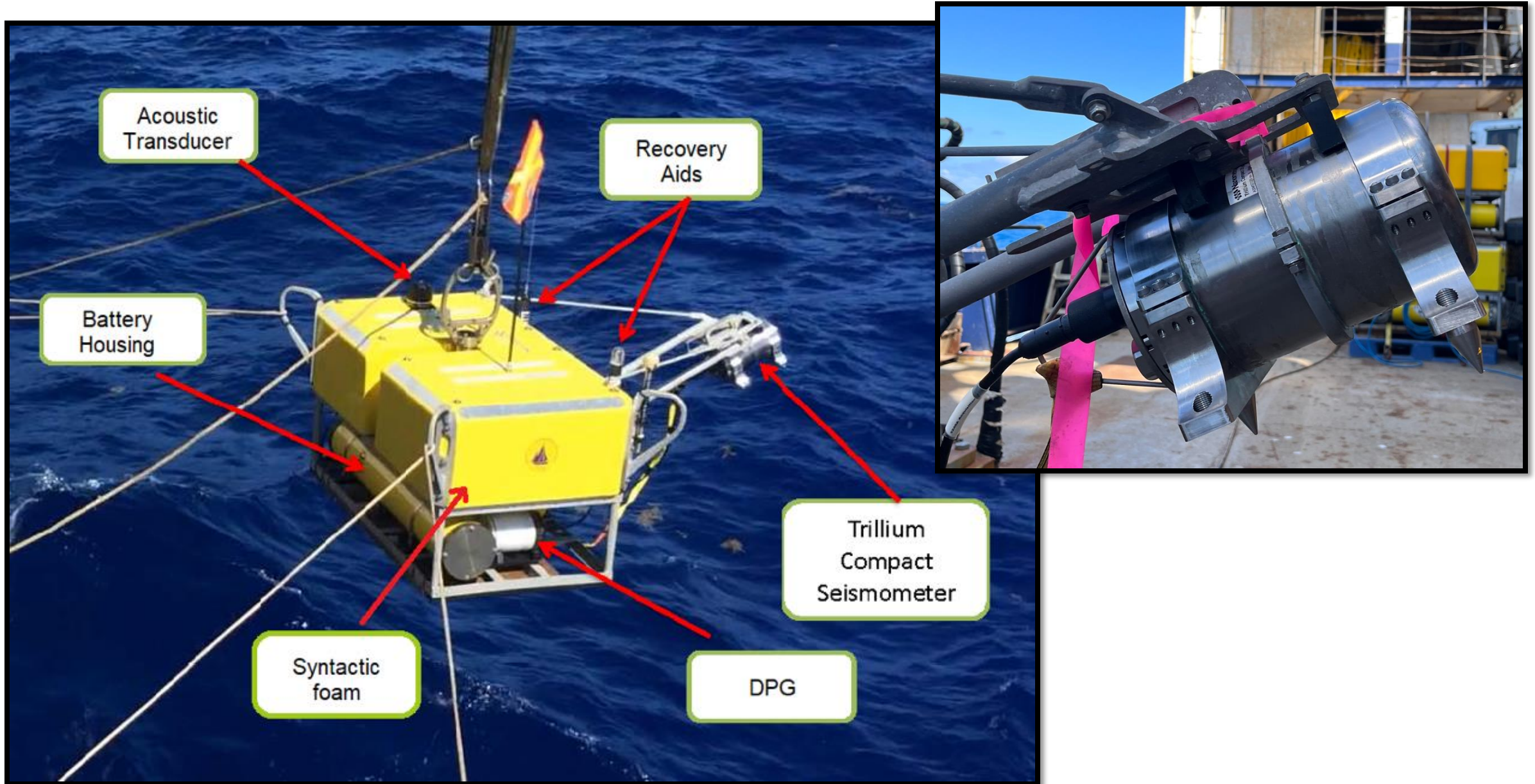
- Teleseismic & Surface wave imaging with anisotropy
- Shear-wave splitting
- Receiver functions

Geologic Setting of the Galápagos Archipelago



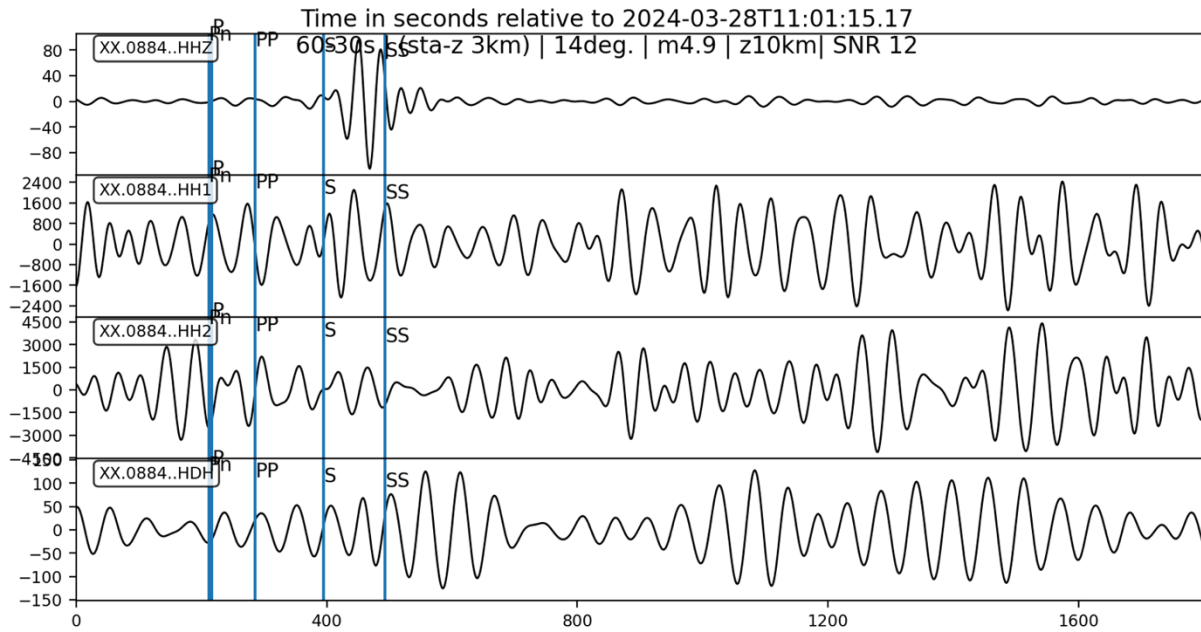


This experiment: ocean bottom seismometers



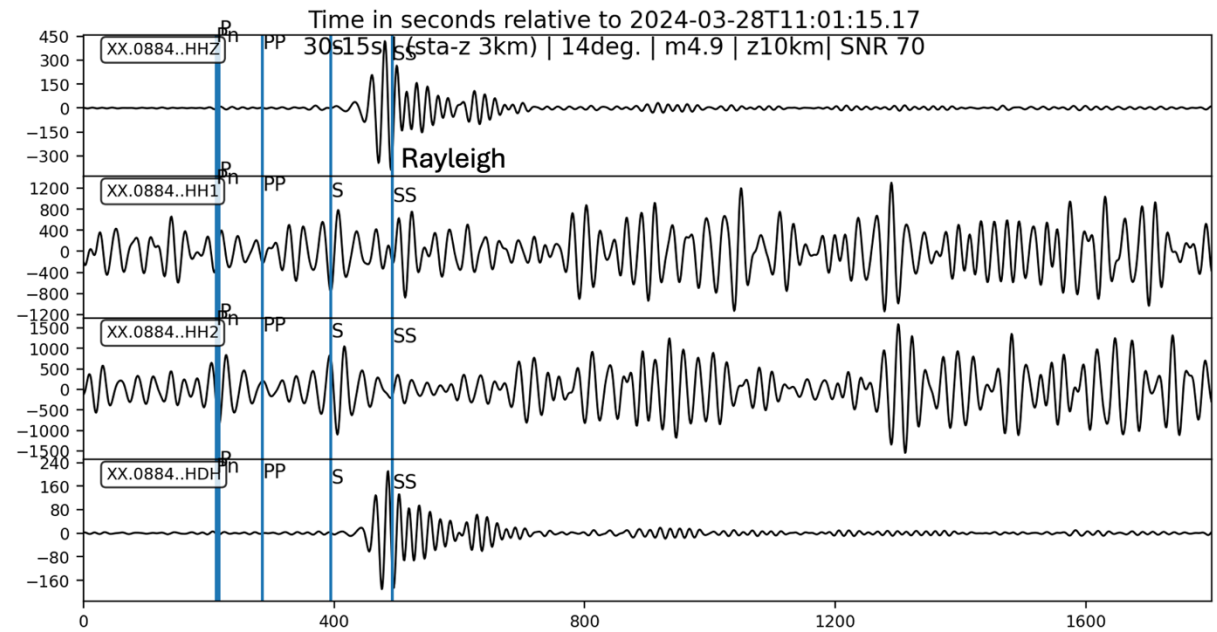
Regional earthquake waveforms in two filter bands for OBS AN106-56 and earthquake of M4.9 at 14°.

60-30s, SNR 12



Regional Earthquake

30-15s, SNR 70



Vertical components

Waveforms on OBS AN106-56 for a magnitude 6.4 event at distance of 31° and filtered from 30 to 15 seconds period.

