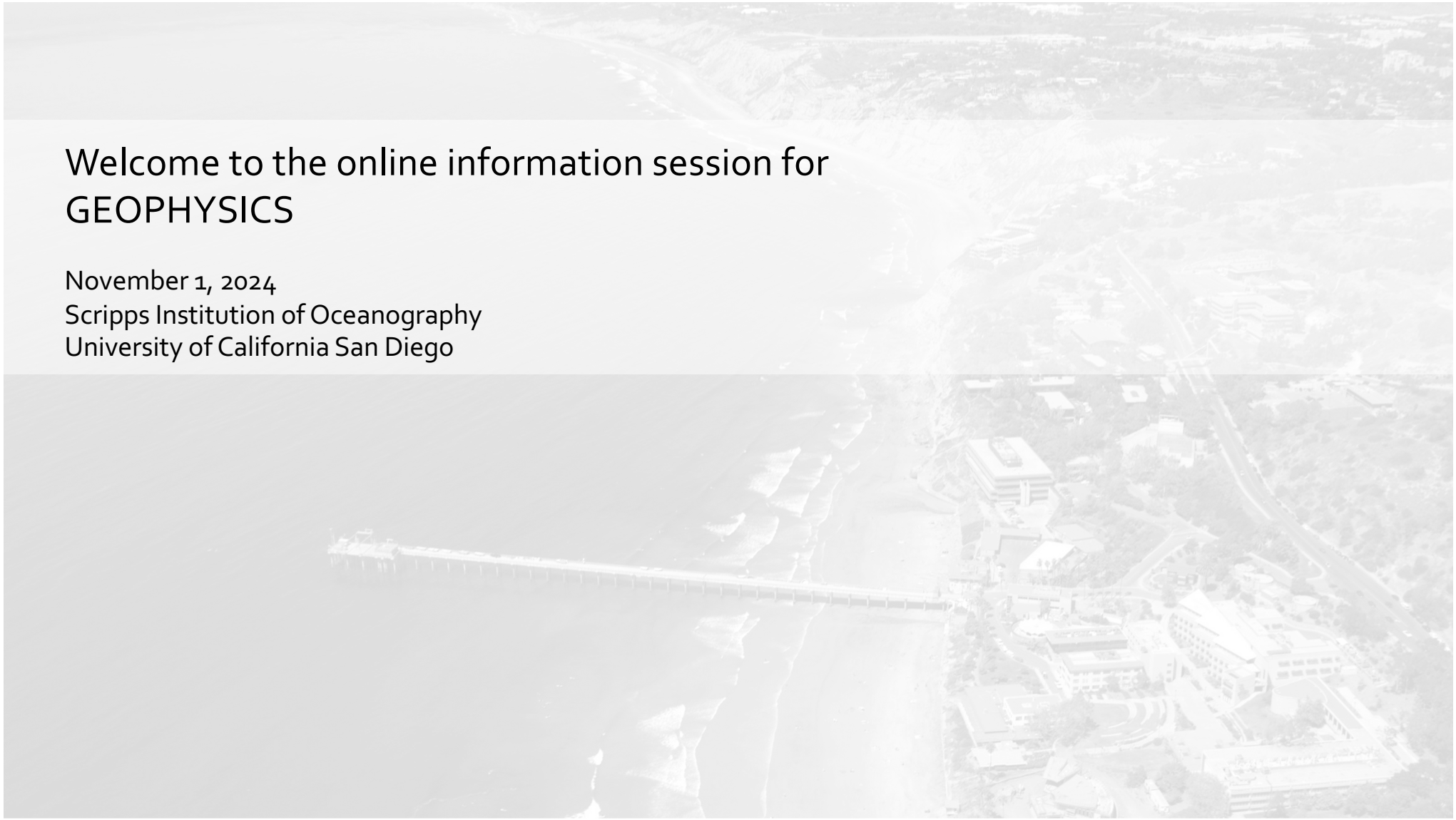
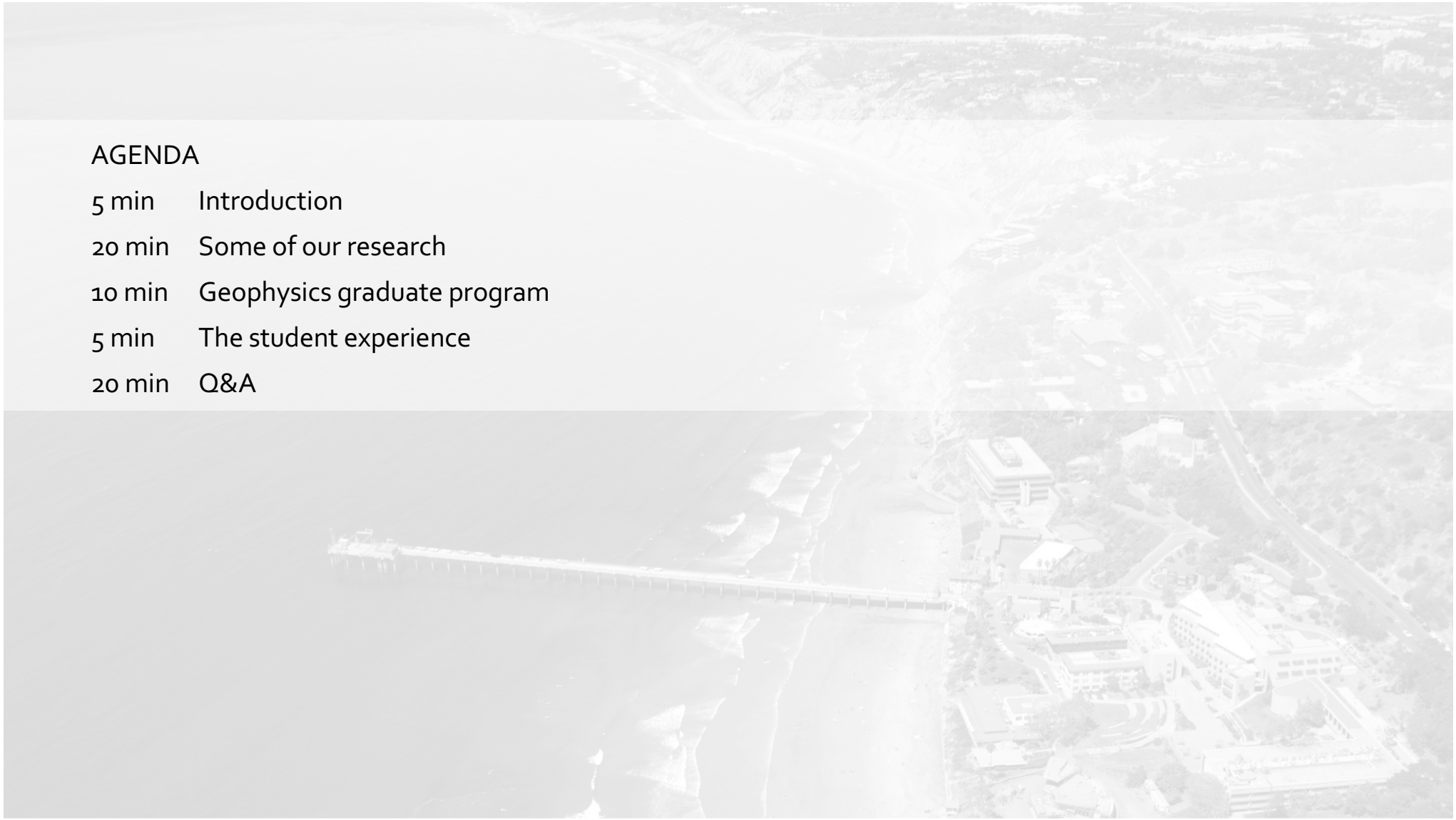


Welcome to the online information session for GEOPHYSICS

November 1, 2024
Scripps Institution of Oceanography
University of California San Diego



AGENDA

5 min	Introduction
20 min	Some of our research
10 min	Geophysics graduate program
5 min	The student experience
20 min	Q&A


Institute of Geophysics
and Planetary Physics

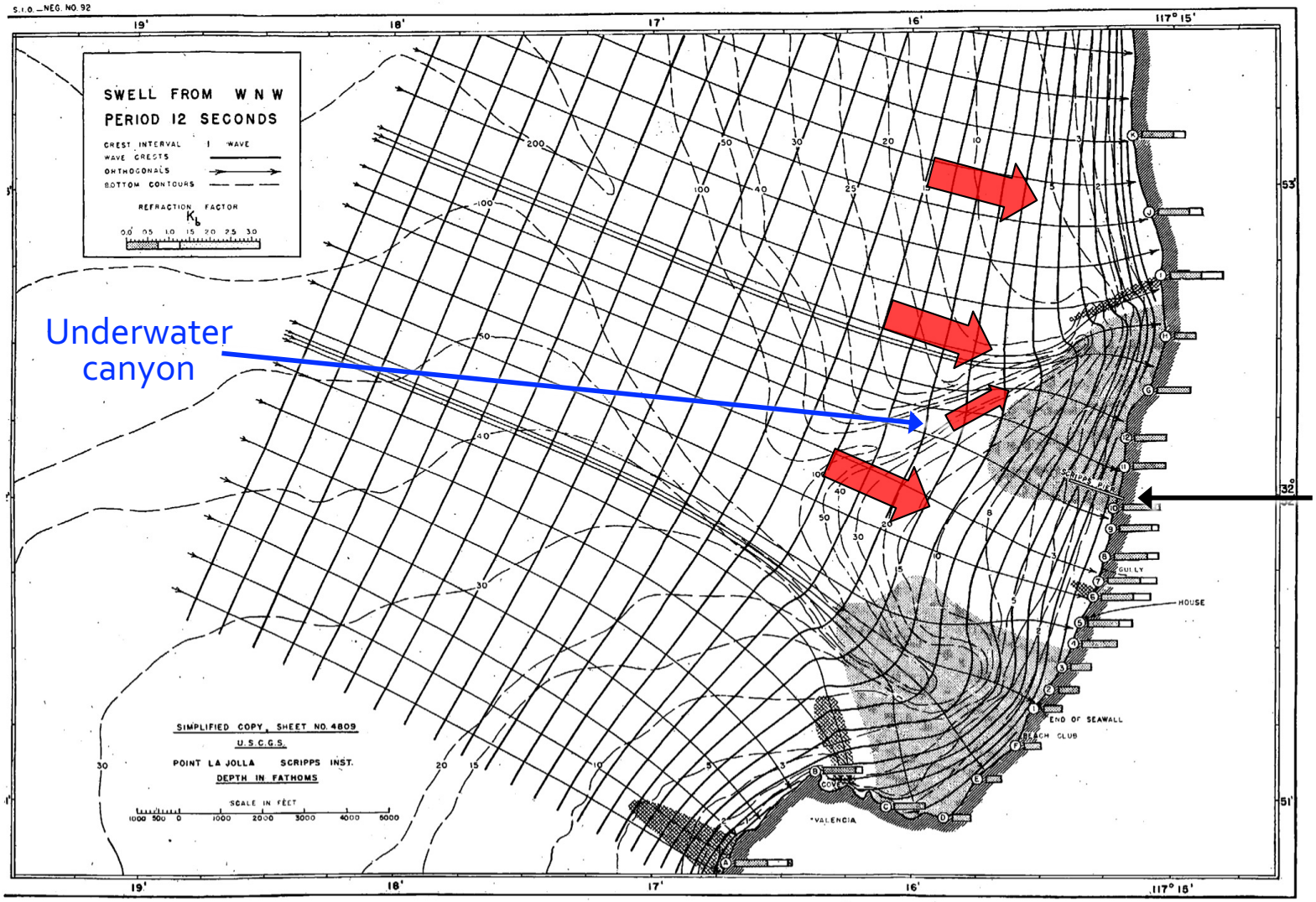


FIG. 9.—The general refraction pattern is similar to the one in Fig. 8 but, owing to the shorter wave period, variations in wave height are smaller

Blacks Beach

Surfer Magazine, 1998

THE JOURNAL OF GEOLOGY

January 1947

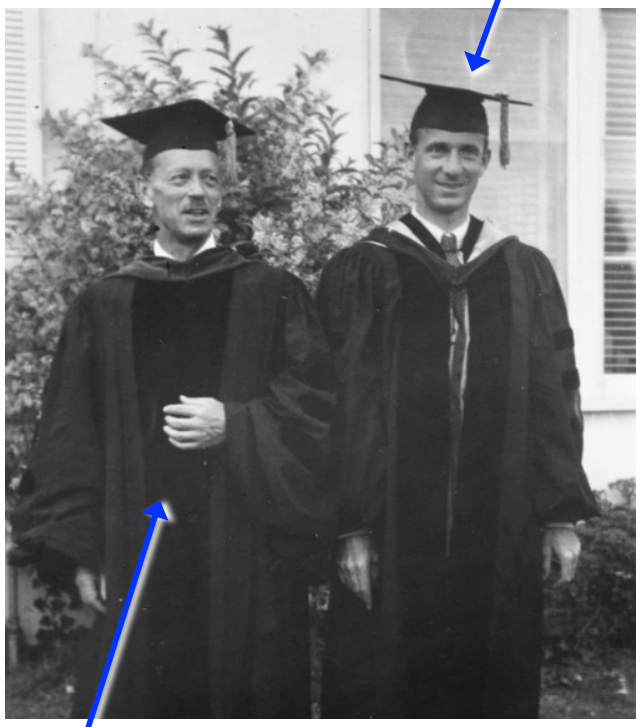
REFRACTION OF OCEAN WAVES: A PROCESS LINKING UNDERWATER TOPOGRAPHY TO BEACH EROSION

WALTER H. MUNK AND MELVIN A. TRAYLOR
Scripps Institution of Oceanography[1]

"It is recommended that Mr. Walter H. Munk be appointed Assistant Professor at the Institute of Geophysics [La Jolla branch] beginning July 1, 1947."

Walter Munk

oceanographer and geophysicist



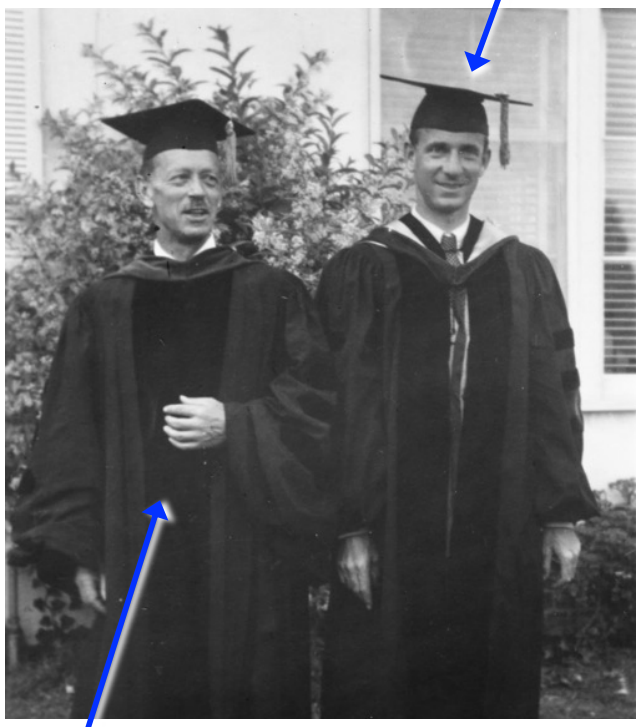
Harold Sverdrup

Scripps Director and Munk's doctoral advisor

What's in our DNA?

Walter Munk

oceanographer and geophysicist



Harold Sverdrup

Scripps Director and Munk's doctoral advisor

What's in our DNA?

From Harold Sverdrup

- The need for physics-based models
- Respect for data

Madingley Rise (Department of Geodesy and Geophysics at Cambridge University)

Where Munk spent his sabbatical in 1956

What's in our DNA?

From Harold Sverdrup

- The need for physics-based models
- Respect for data

From Cambridge

- Physical models backed up by math
- Instrument-building

From New Jersey (Bell Labs)

- Use of advanced methods for data analysis

At Scripps, you will have the opportunity to go into the field (sea and land), collect data with instruments you might have built yourself, process and analyze your data using methodologies you will learn in class and from your colleagues, build physics-based models to help interpret your observations, and work with a wide variety of faculty to understand your results within the broader context of the Earth sciences.

SIO's Educational Structure

Department	Program	Curricular Group	
SIO	COAP Climate-Oceans-Atmosphere Program	AOS	Applied Ocean Sciences
		PO	Physical Oceanography
		CS	Climate Science
	GEO Geosciences of the Earth, Oceans, and Planets	GP	Geophysics
		GS	Geoscience
		MCG	Marine Chemistry and Geochemistry
	OBP Ocean Biosciences Program	BO	Biological Oceanography
		MB	Marine Biology

Institute of Geophysics and Planetary Physics (IGPP)

IGPP's UCSD Connections: School of Global Policy and Strategy, School of Engineering, Department of Anthropology, Department of Chemistry, San Diego Supercomputer Center

IGPP Munk building built in 1962 for $625K


Some of our research

Marine Geophysics

Ross Parnell-Turner

Marine Geophysics at IGPP

Steven Constable

Matthew Dzieciuch

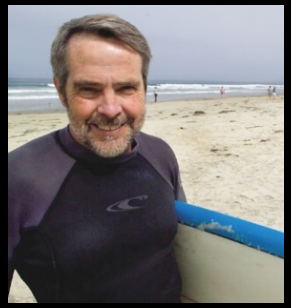
Wenyuan Fan

Jeff Gee

Jamin Greenbaum

Gabi Laske

Ross Parnell-Turner



David Sandwell

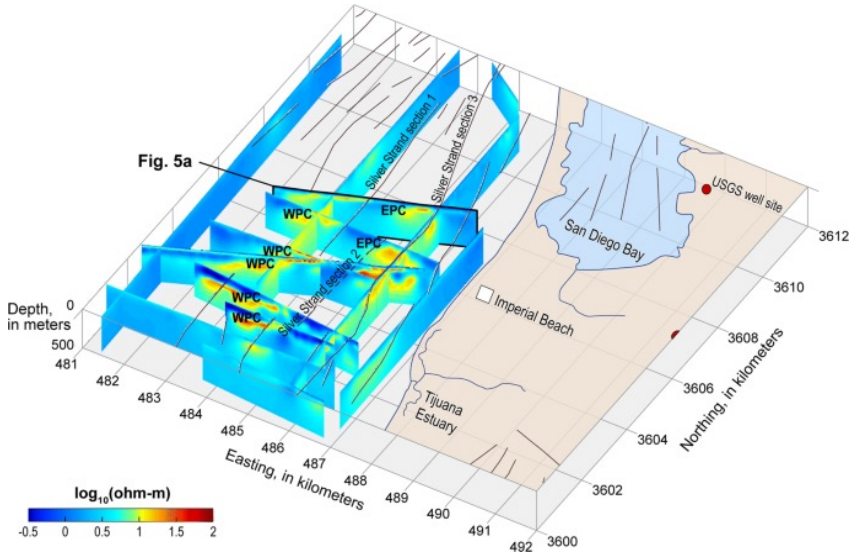
Vashan Wright

Mark Zumberge

Recent Research: Greenbaum

Deploying the Recoverable Ice Fracture Ocean eXplorer (Rift-OX) on Thwaites Glacier, Antarctica

Recent Research: Constable

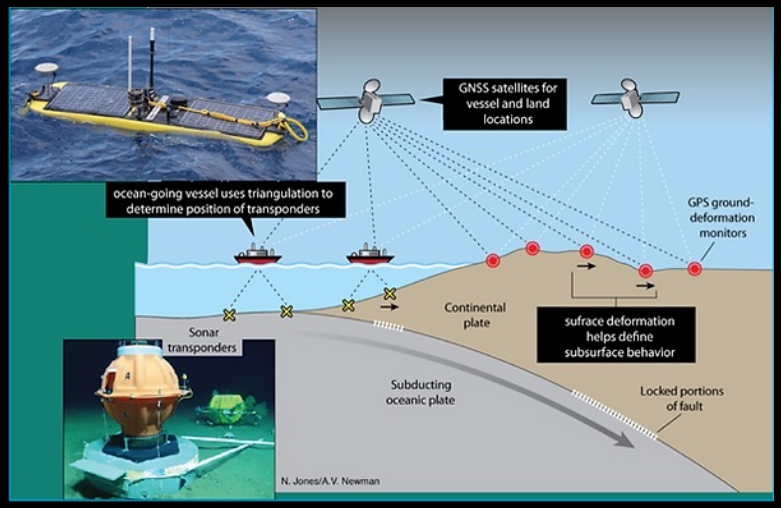


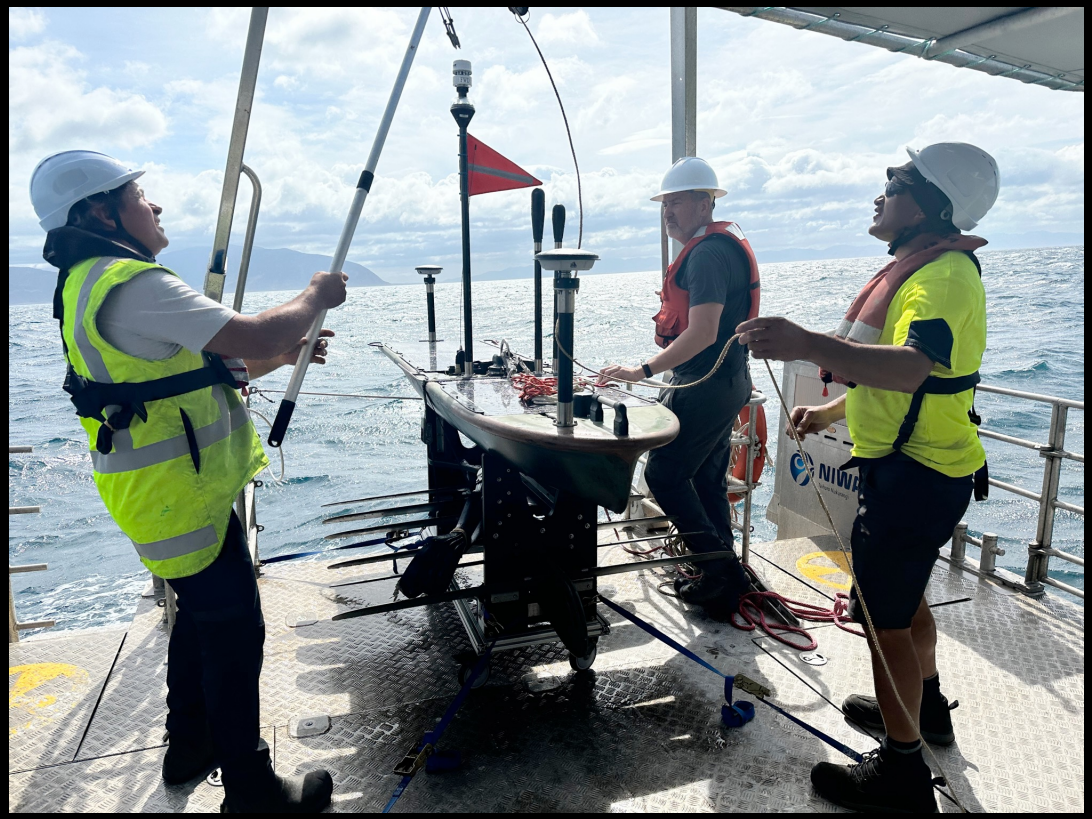
Marine hydrates in California Borderlands

Marine electro-magnetics, Goban spur, N. Atlantic, 2023

Recent Research: Zumberge

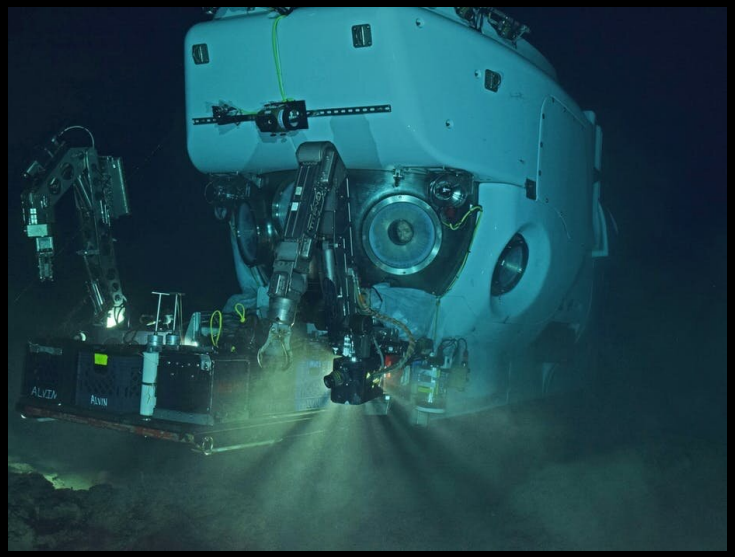
Seafloor geodesy

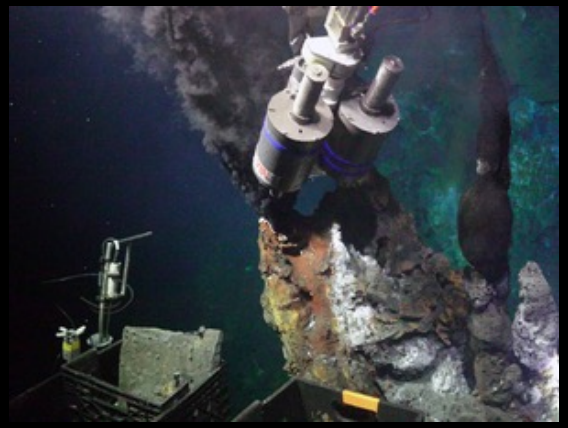




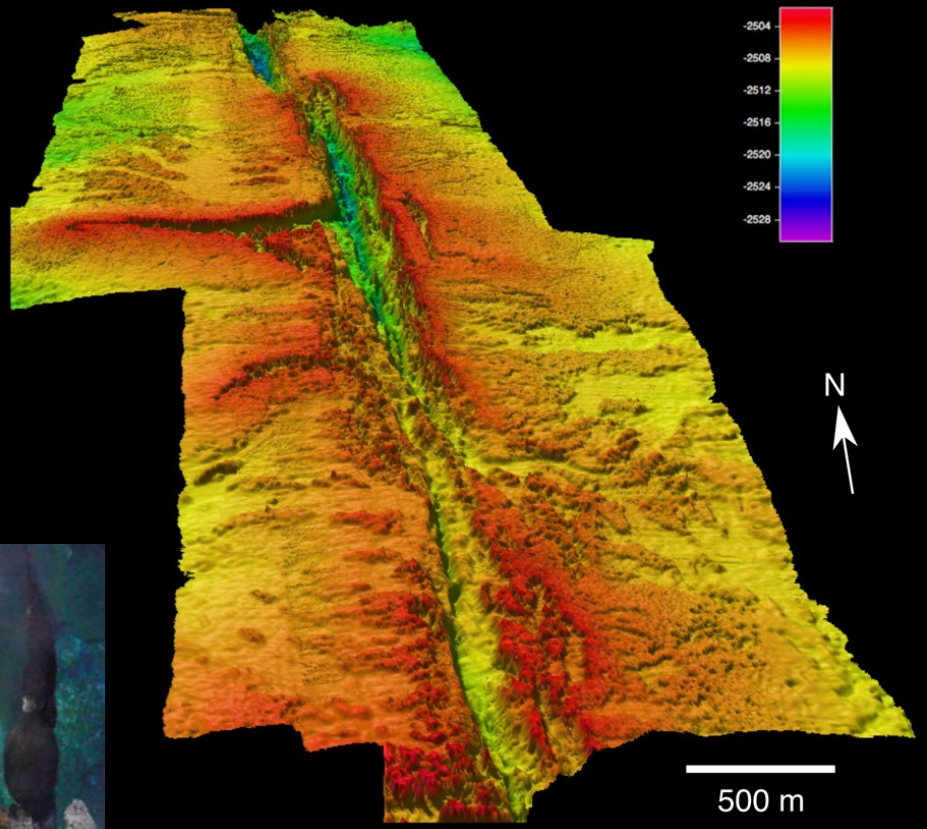
wave glider launch offshore New Zealand for GNSS-Acoustic survey

Recent Research: Parnell-Turner

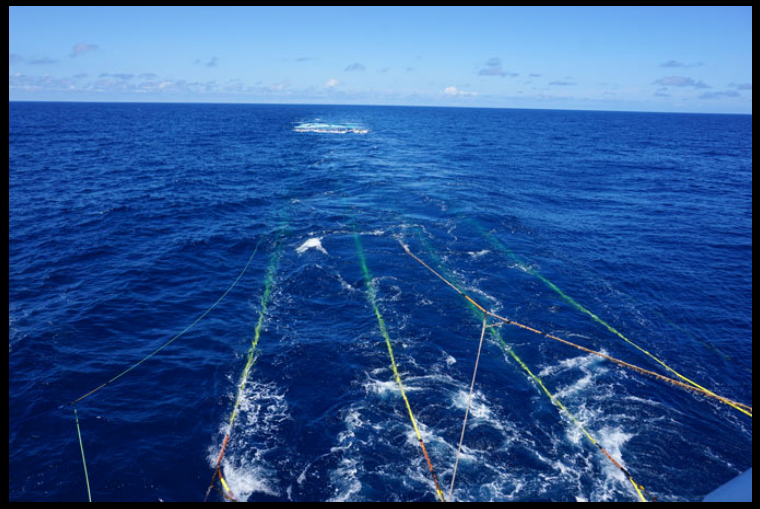


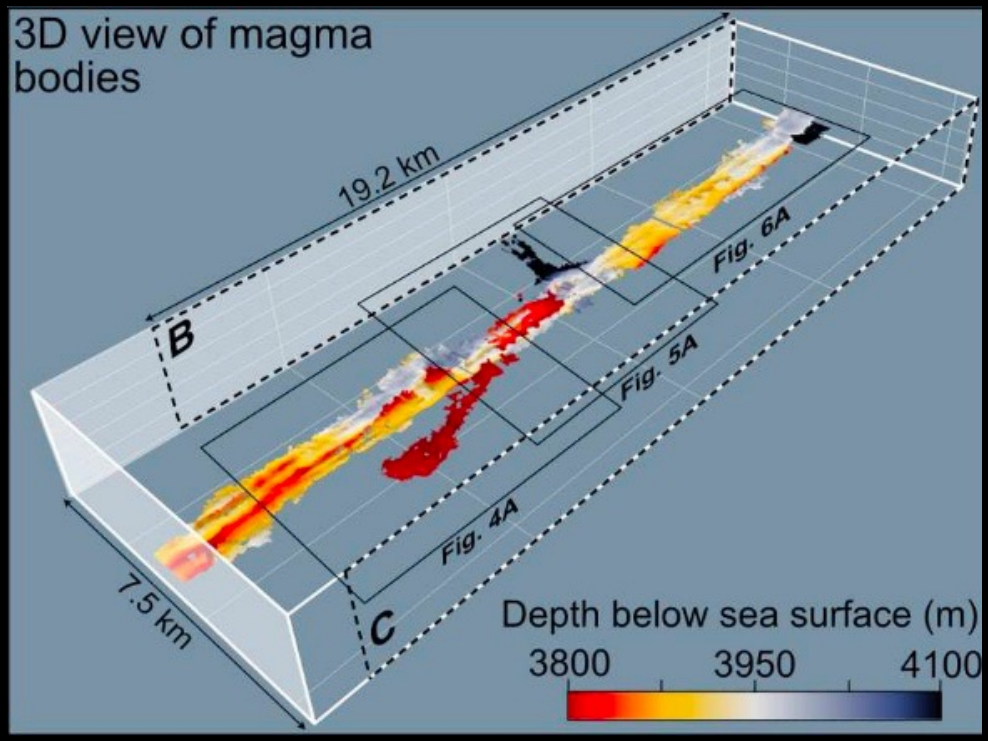


Measuring hydrothermal flux at black smokers



Multichannel seismic imaging

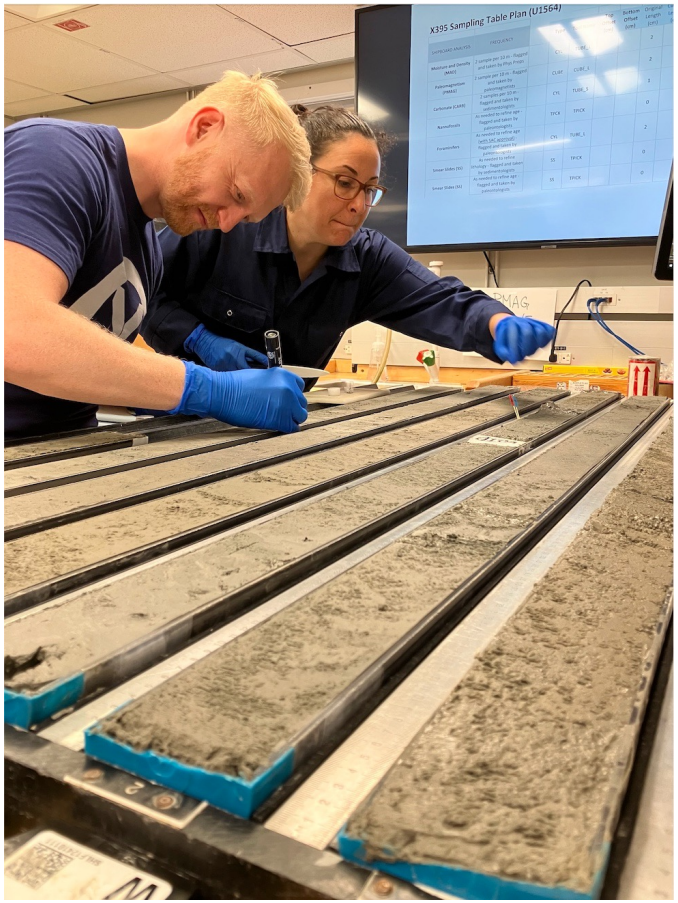


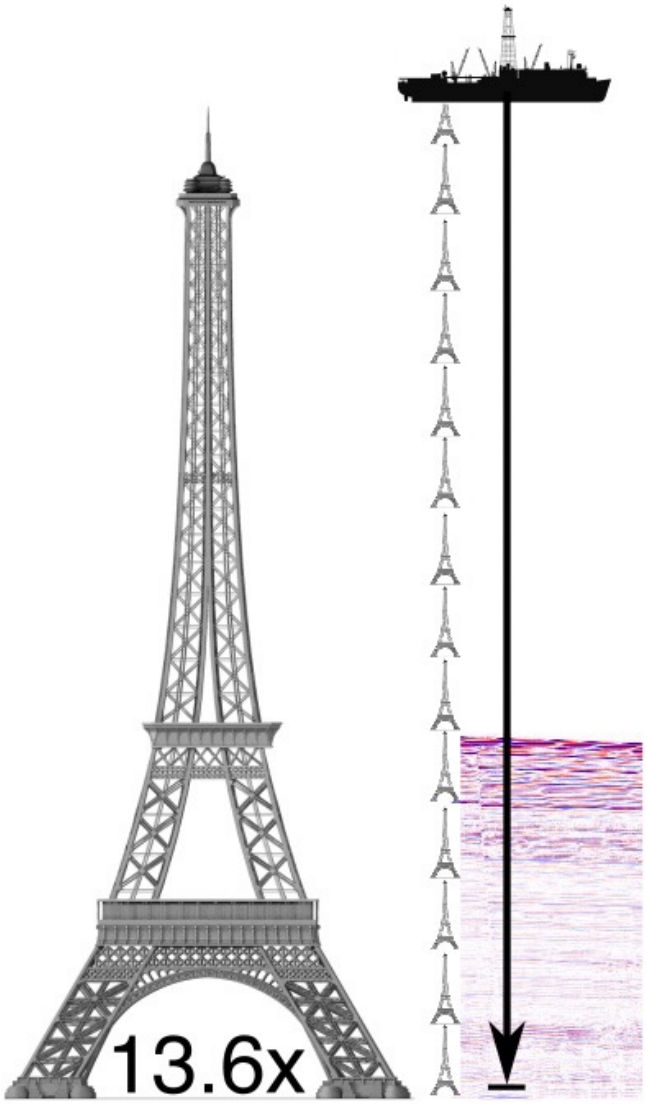


4D experiment coming in 2026…

Scientific Ocean Drilling

Offshore Greenland, 2023





Sail the Scripps fleet at grad school…

R/V *Roger Revelle*

R/V *Sally Ride*

R/V *Robert Gordon Sproul*

R/V *Bob and Betty Beyster*

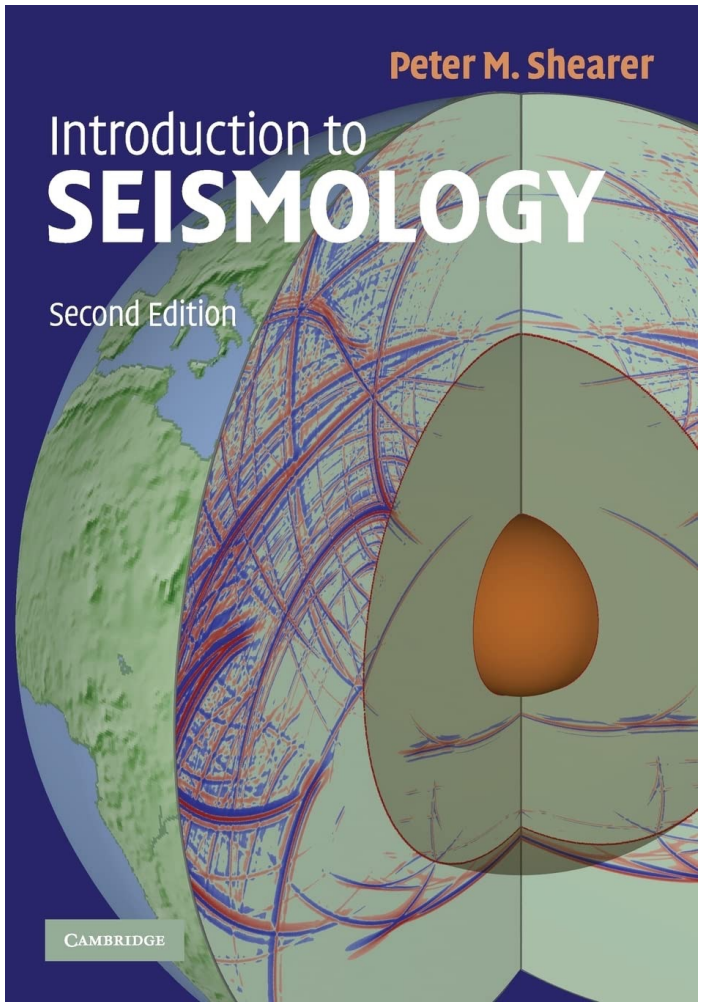
Hydrogen-hybrid vessel: coming

Credit: Glosten

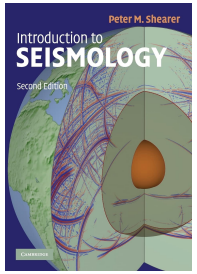
Seismology

Alice Gabriel

IGPP Seismology

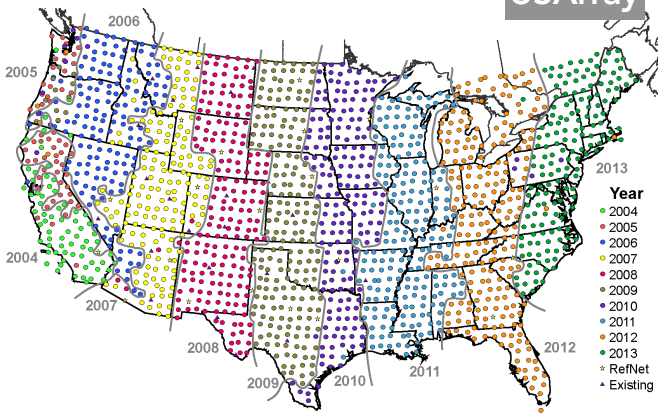


IGPP Seismology

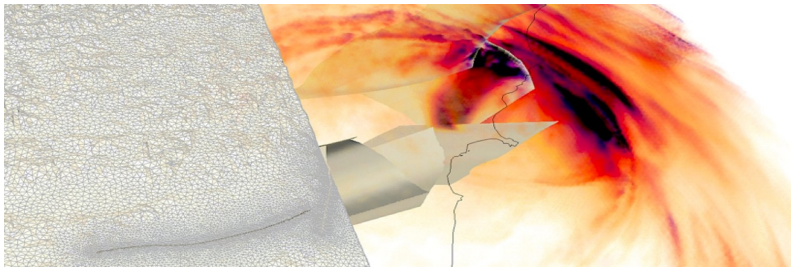


1. Large datasets
2. High performance computing + ML
3. Off-shore, DAS, array observations

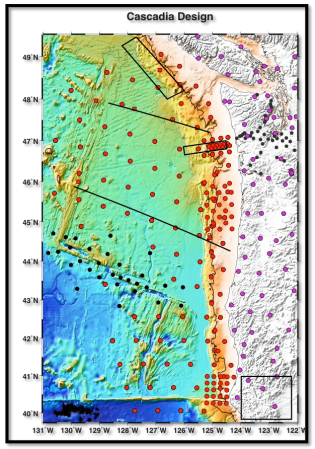
USArray



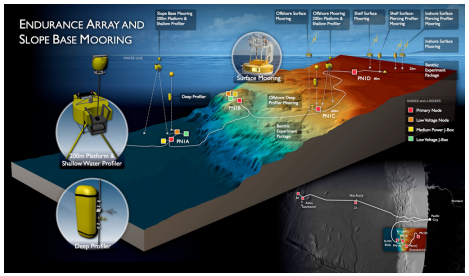
High performance computing



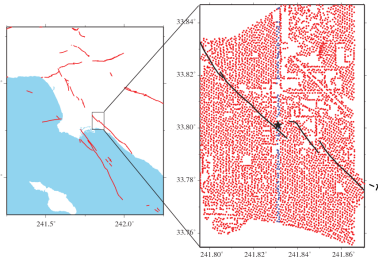
Cascadia Initiative



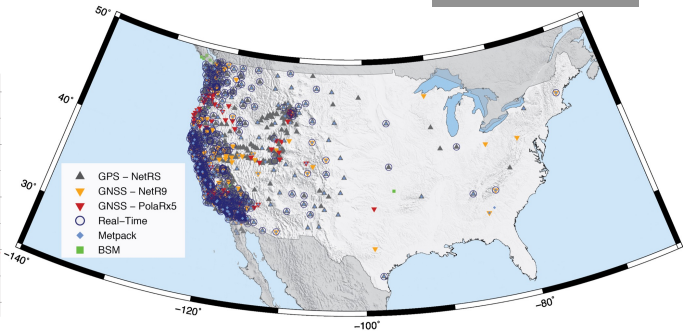
OOI Cascadia cable array



Large-N nodal array



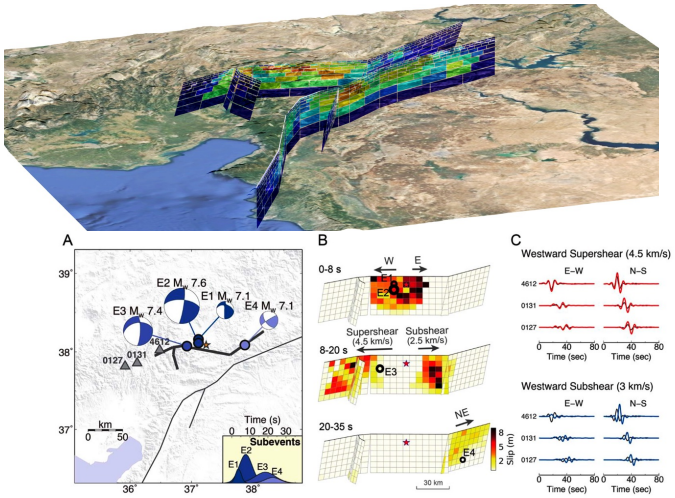
NOTA (PBO)



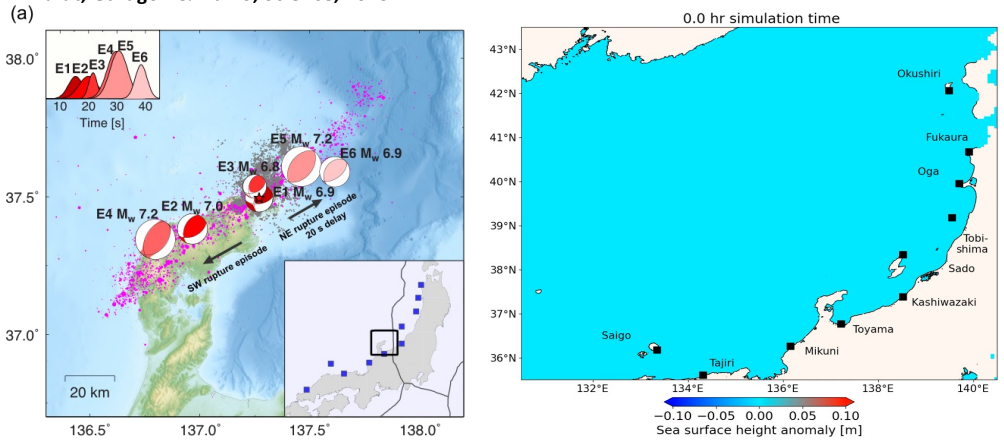
cascadiaoffshore.org; unavco.org; usarray.org; iris.edu

Recent highlights

- Cross-IGPP collaborations, e.g., 2023 Turkey earthquake doublet, 2024 Noto earthquake & tsunami
- Large-scale interdisciplinary community efforts, e.g., SCEC, CRESCENT, SZ4D, CIG, Quakeworx …



The first mainshock of the 2023 Turkey earthquake sequence. The total rupture length is more than 300 km (only a small fraction is shown in the photo), resulting from an unlikely cascade of events that broke through multiple potential barriers. **Jia, Jin, Marchandon, Ulrich, Gabriel, Fan, Shearer, Zou, Rekoske, Bulut, Garagon & Fialko, Science, 2023**



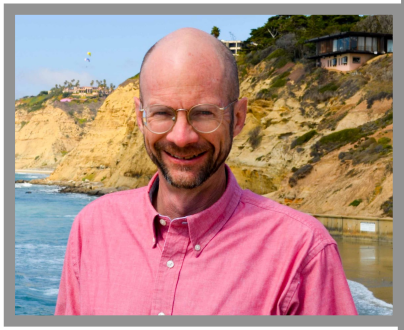
The Multi-Segment Complexity of the 2024 Mw 7.5 Noto Peninsula Earthquake Governs Tsunami Generation. Kutschera, Z. Jia, B. Oryan, J. Wong, W. Fan, and A.-A. Gabriel, GRL, in press

Contact us to discuss potential seismology projects!

POTENTIAL ADVISORS AND PROJECTS FOR FALL 2025 ADMISSION

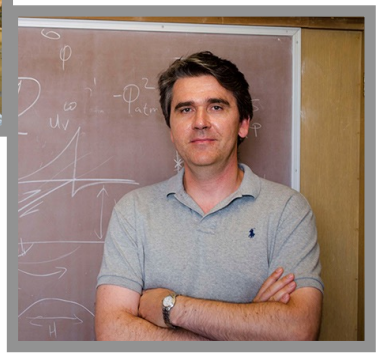
Gabi Laske
<glaske@ucsd.edu>
Observational seismology. Research projects typically cover aspects of structural seismology. Primary targets are the measurement and tomographic modeling of surface wave dispersion in combination with other seismic observables. Our research projects often involve the collection and analysis of ocean bottom seismic data in the Pacific ocean. A new project is the OHANA project that focuses on the seismic imaging of 4-50 Myr old Pacific lithosphere halfway between Hawaii and California.
Website: igppweb.ucsd.edu/~gabi

Wenyuan Fan
<wenyuanfan@ucsd.edu>
Observational seismology. We focus on seismic sources and use onshore and offshore, dense array seismic observations to investigate earthquakes, slow earthquakes, subduction zone processes, environmental processes, and their interaction and triggering.
Website: igppweb.ucsd.edu/~wenyuanfan



Peter Shearer
<pshearer@ucsd.edu>
Seismology. Peter Shearer may have funding to support a student to study earthquakes and/or Earth structure.
Website:
https://igppweb.ucsd.edu/~shearer/mahi

Alice Gabriel
<algabriel@ucsd.edu>
Computational and theoretical seismology. Projects are available which use high-performance computing and physics-based modeling constrained by a multitude of observations. Application areas range from the seismic cycle in subduction zones and tsunami genesis, to strong ground motion scenarios in complicated settings, to induced seismicity. Projects may involve utilising new methods in terms of numerical discretisation, uncertainty quantification, imaging and monitoring.
Website: www.alicegabriel.com



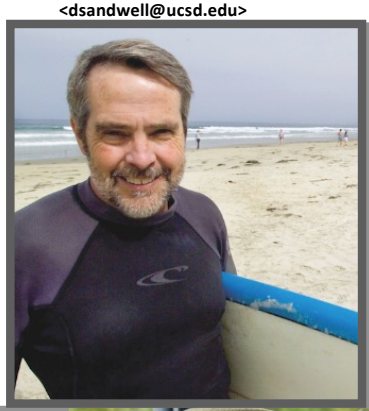
Yuri Fialko
<yfialko@ucsd.edu>
Space geodesy (InSAR/GNSS), earthquake and volcano deformation, active tectonics, numerical modeling, theoretical and experimental rock mechanics. Potential projects include studies of time-dependent deformation in California, Tibet, and Turkey.
Website: igppweb.ucsd.edu/~fialko

We are more!

Dave May
<dmay@ucsd.edu>
Theoretical geophysics

Ross Parnell-Turner
<rparnellturner@ucsd.edu>
Marine geophysics
Earth and planetary interior

David T. Sandwell
Geodesy
<dsandwell@ucsd.edu>



Deborah Kilb
<dkilb@ucsd.edu>

Guy Masters
<gmasters@ucsd.edu>

Duncan Agnew
<dagnew@ucsd.edu>

Jennifer Haase
<jhaase@ucsd.edu>
Geodesy and tectonics
Atmosphere science
Earthquake and tsunami

Frank Vernon
<fvernon@ucsd.edu>

Rob Mellors
<rmellors@ucsd.edu>
GSN, DAS

Mark Zumberge
<mzumberge@ucsd.edu>
Geodesy and tectonics
Gravity

Polar Science

Helen Fricker

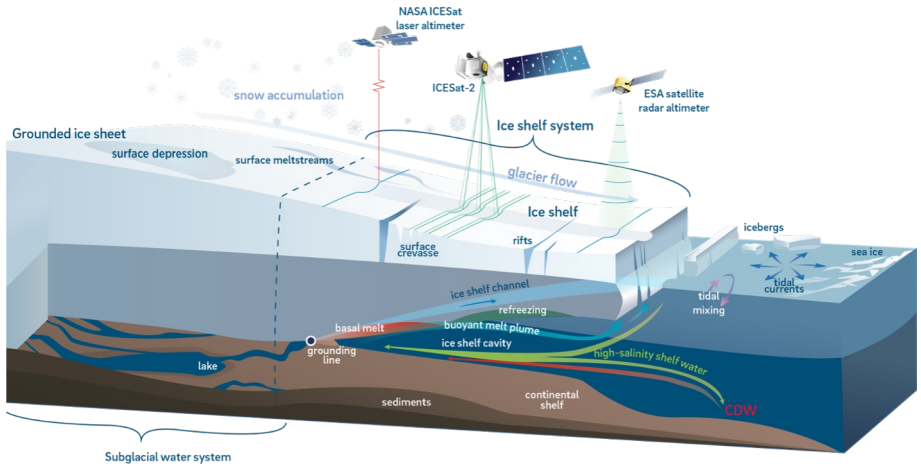
Scripps Polar Center

Mission Statement

The Scripps Polar Center brings together scientists from the three research sections of the Scripps Institution of Oceanography at UC San Diego who investigate everything from ocean physics to the ecology of polar organisms. We aim to address the complex questions of today's polar regions and to train a new generation of scientists capable of interdisciplinary research.

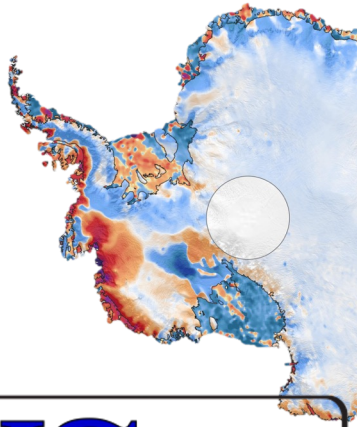
Monitoring ice sheet change

IGPP faculty and researchers have unique technological & scientific capabilities that contribute to obtaining critical observations in these challenging environments:



Satellite and airborne remote sensing, e.g. laser and radar altimetry and InSAR for ice thickness, melt rates, ice velocity and grounding line delineation.

Geophysical systems on ice shelves & subglacial lakes, e.g. ice-penetrating radar for ice thickness, e/m for subglacial water detection and permafrost depth, joint GNSS/seismic deployments to study the dynamics of ice flow and subglacial hydrology.



ISMIP6
Ice Sheet Model Intercomparison Project for CMIP6

POLAR CENTER
SCRIPPS INSTITUTION OF OCEANOGRAPHY

SIO is a leader in acquiring observations in the polar regions.

Scientific

Journal of Glaciology, Vol. 53, No. 183, 2007 523

Seismicity and deformation associated with ice-shelf rift propagation

Jeremy N. BASSIS,[1] Helen A. FRICKER,[1] Richard COLEMAN,[2,3,4] Yehuda BOCK,[1] James BEHRENS,[1] Dennis DARNELL,[1] Marianne OKAL,[1] Jean-Bernard MINSTER[1]

[1]*Institute for Geophysics and Planetary Physics, Scripps Institution of Oceanography, University of California-San Diego, La Jolla, California 92093-0225, USA*
E-mail: jbassis@ucsd.edu
[2]*Center for Marine Science, University of Tasmania, Private Bag 78, Hobart, Tasmania 7001, Australia*
[3]*CSIRO Marine and Atmospheric Research, GPO Box1538, Hobart, Tasmania 7001, Australia*
[4]*Antarctic Climate and Ecosystems CRC, Box252-80, Hobart, Tasmania 7001, Australia*

ABSTRACT. Previous observations have shown that rift propagation on the Amery Ice Shelf (AIS), East Antarctica, is episodic, occurring in bursts of several hours with typical recurrence times of several weeks. Propagation events were deduced from seismic swarms (detected with seismometers) concurrent

"All the News That's Fit to Print"

The New York Times

Late Edition

VOL. CLXVI... No. 57,637 NEW YORK, THURSDAY, JULY 13, 2017 $2.50

F.D.A. PANEL URGES NEW 'LIVING DRUG' TO FIGHT CANCER

MILESTONE IN MEDICINE

Treatment That Alters a Patient's Own Cells to Fight Back

Antarctica Sheds Huge Iceberg That Hints at Future Calamity

The Larsen C ice shelf on the Antarctic Peninsula in February. NASA says a chunk of ice broke away this week, producing one of the largest icebergs ever recorded.

BBC NEWS

Climate change: Satellites record history of Antarctic melting

By Jonathan Amos
BBC Science Correspondent

10 August 2020

GETTY IMAGES

Ice shelves can extend under the water for many hundreds of metres

Huge volume of water detected under Antarctic ice

Jonathan Amos
Science correspondent
@BBCAmos

5 May

Climate change

KERRY KEY/COLUMBIA UNIVERSITY

The team collected their measurements during a multi-week expedition

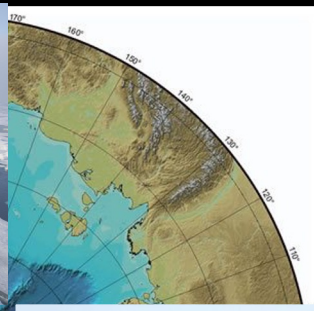
Vast quantities of water have be part of the West Antarctic ice sh

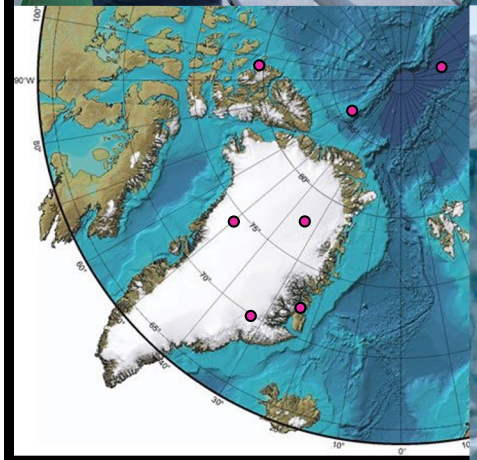
POLAR CENTER

SCRIPPS INSTITUTION OF OCEANOGRAPHY

SIO Polar fieldwork

Opportunities for international, interdisciplinary work in the Arctic, Greenland and Antarctica

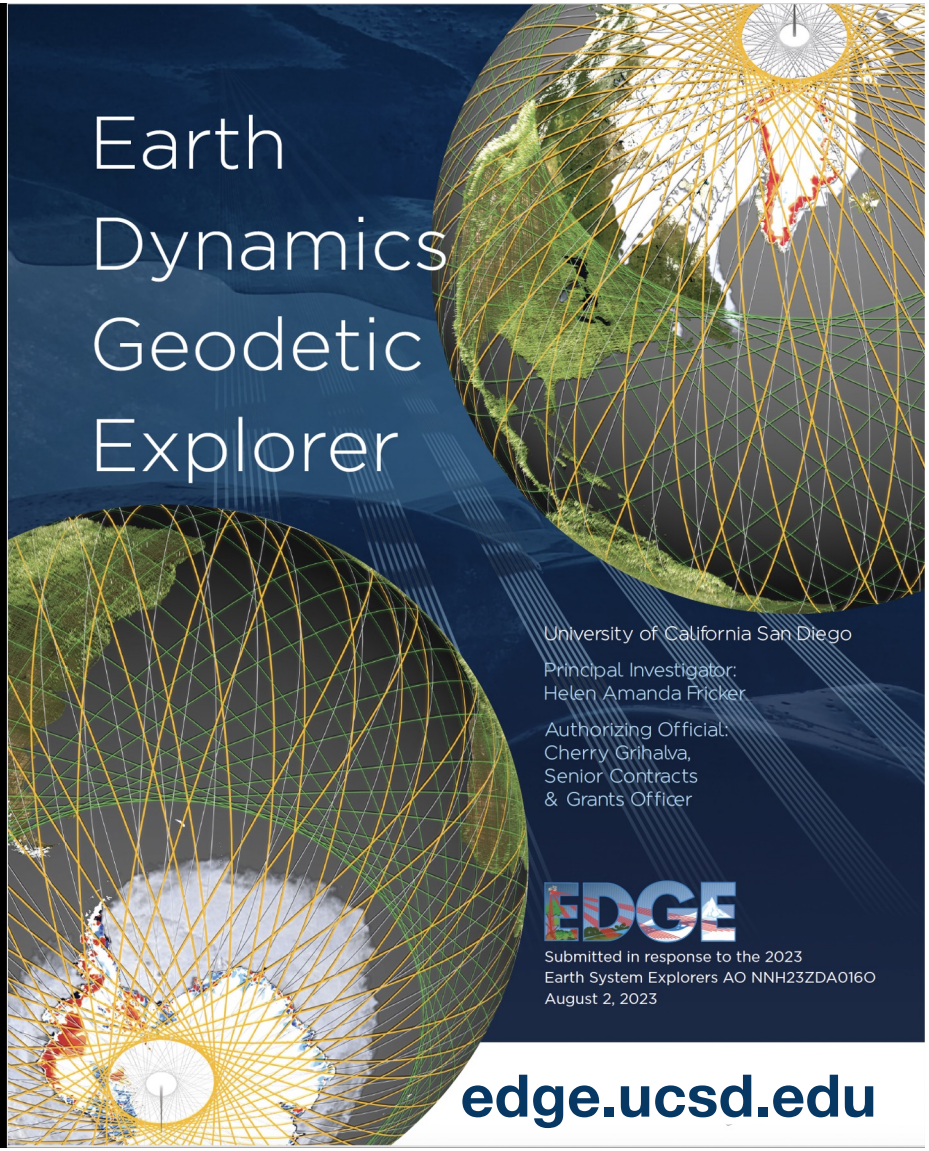




EDGE

Earth Dynamics Geodetic Explorer

EDGE was selected for a competitive Phase A Concept Study within NASA's Earth Systems Explorer (ESE) Announcement of Opportunity

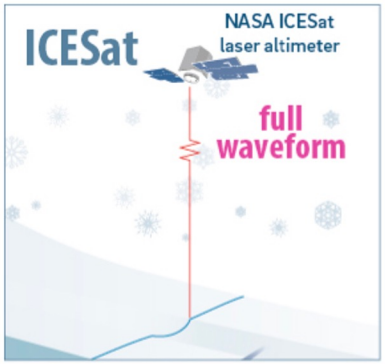


Earth Dynamics Geodetic Explorer

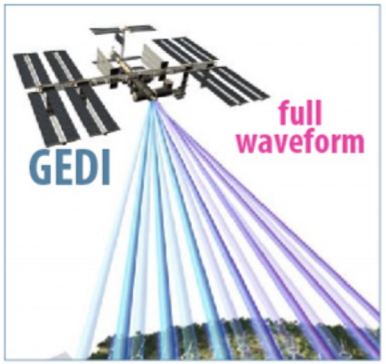
EDGE is an advance from multi-beam profiling to swath-mapping full-waveform geodetic lidar.

This advance in spatial sampling, precision and accuracy enables process-scale understanding of vegetation and ice.

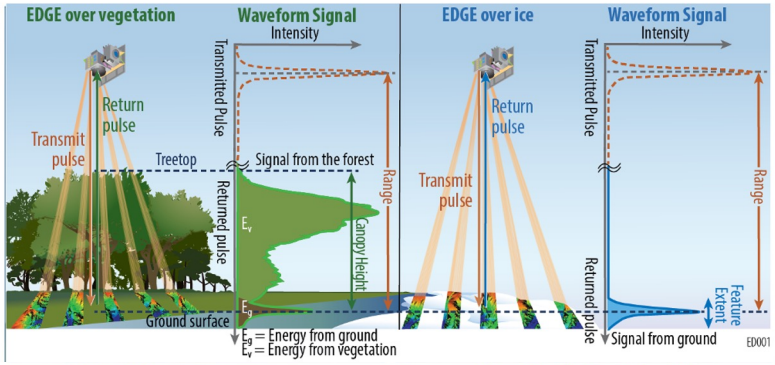
SINGLE-BEAM PROFILING



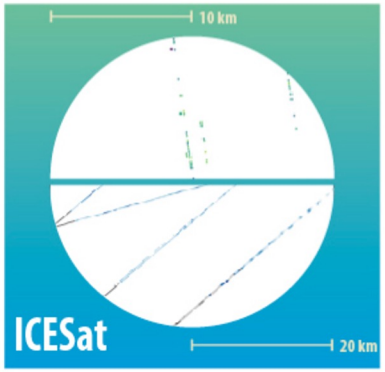
4-6 BEAM PROFILING

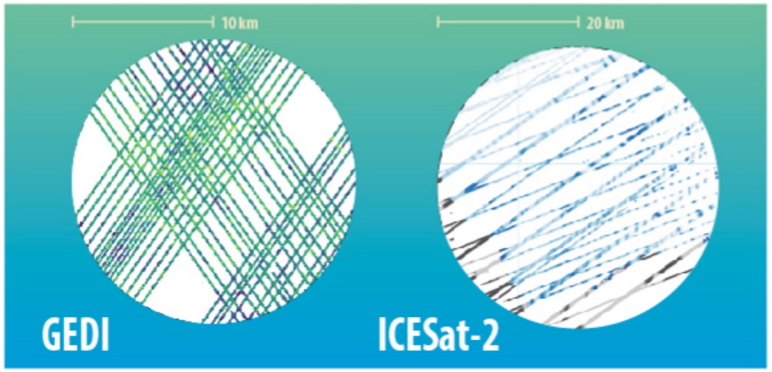


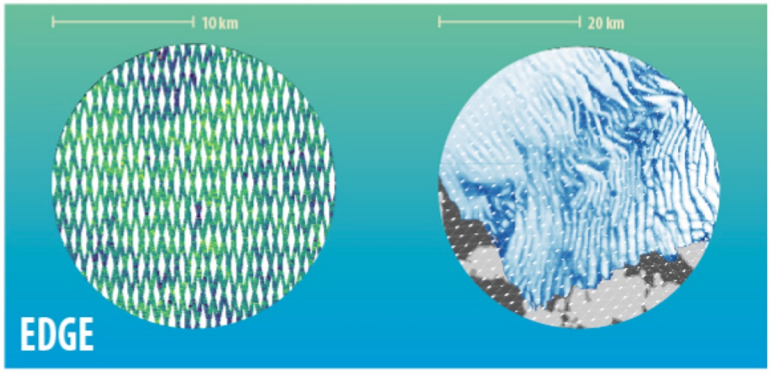
EDGE 40 BEAM SWATH MAPPING



2003 → **2018** → **2030** → **Future STV**

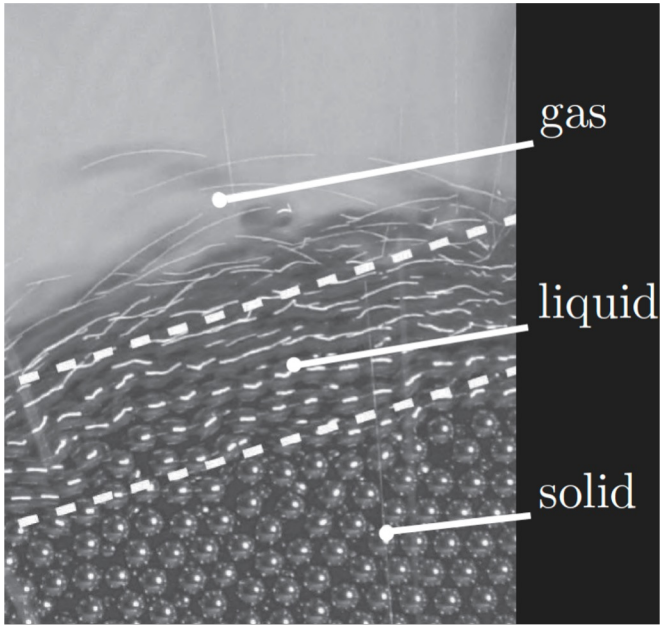


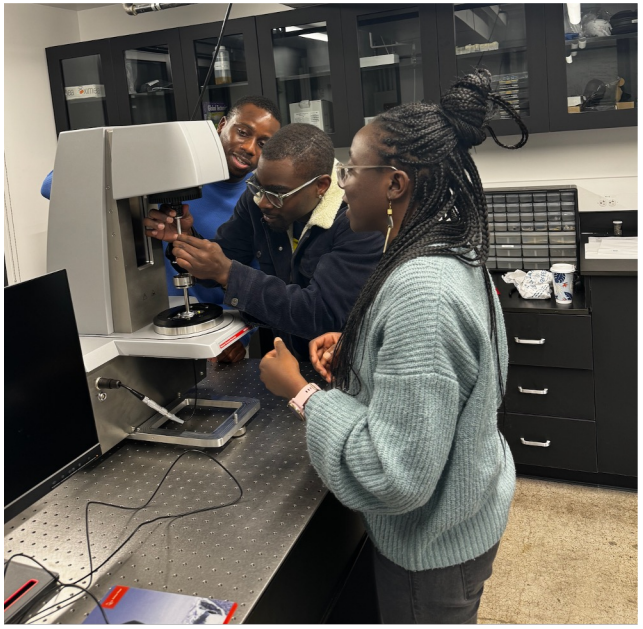




Soft Earth Geophysics

Vashan Wright



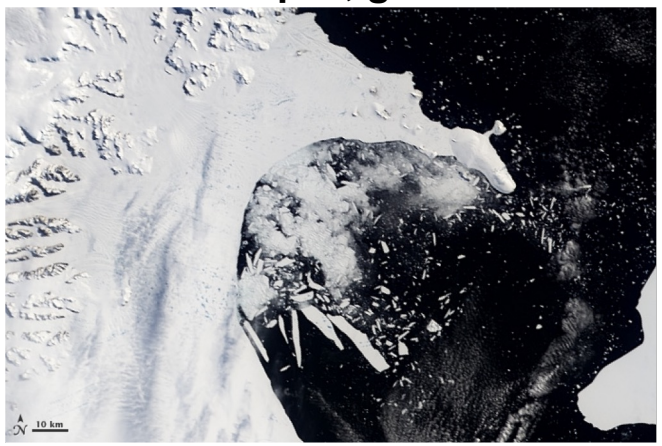


Soft Earth Geophysics
@STRPL

www.stripplelab.ucsd.edu

70% of the Solid Earth comprises amorphous/granular media

Ice shelf collapse, glaciers



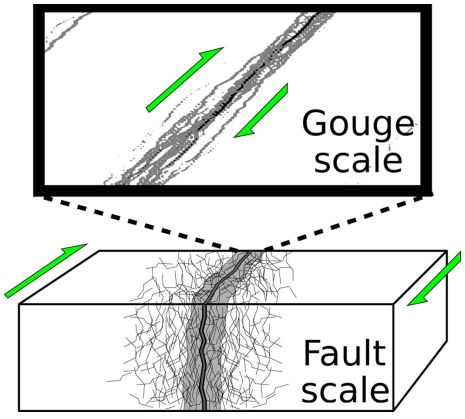
Crystal-rich magmas

Slope failures

Pyroclastic density currents

Liquefaction

Earthquakes



Their flow is important for:

Natural Hazards

Deep Earth Processes (magma can be modeled as a dense suspension)

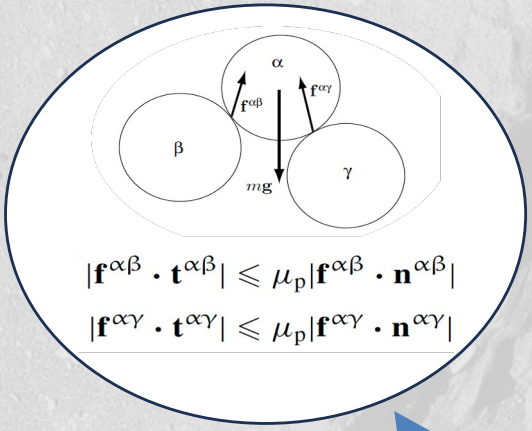
Near-Surface Processes (Compaction, Aging, Creeping, Fluid Flow, Site Response)

Recognizing that earth materials are a part of a broad class of

SOFT MATTER helps!

***Test & expand granular flow theories* to understand the physics controlling the solid-like to fluid-like state transitions in planets**

Theory



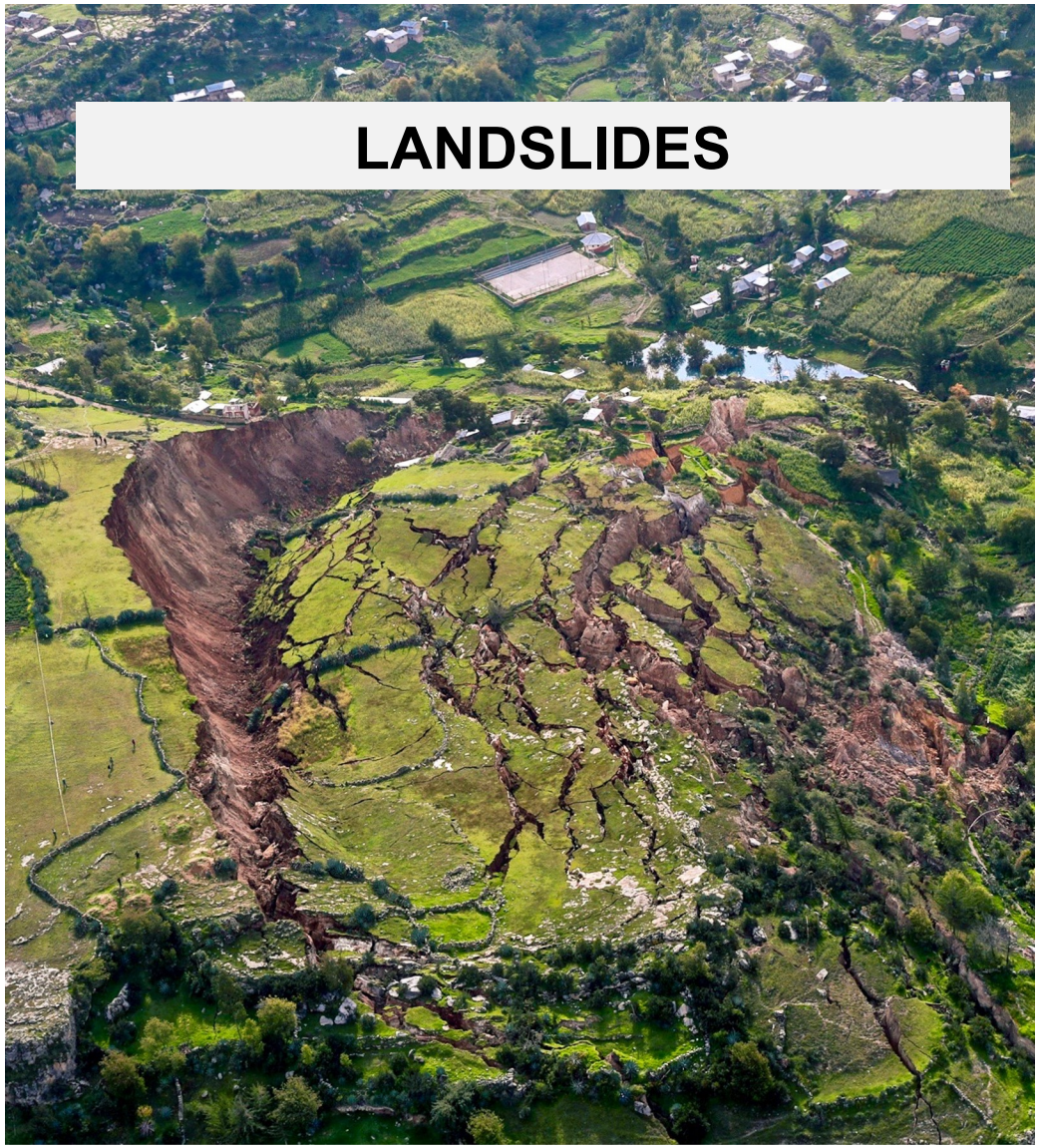
Phenomenologies

Lab experiments

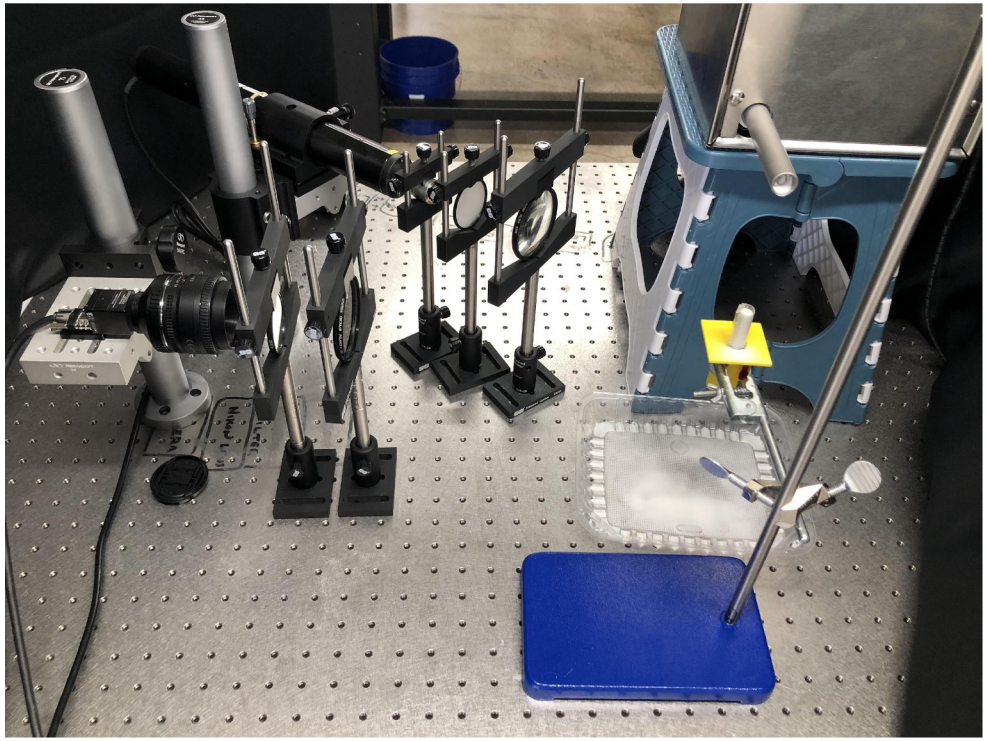
Pheno-menologies

Inform each other

Field observations

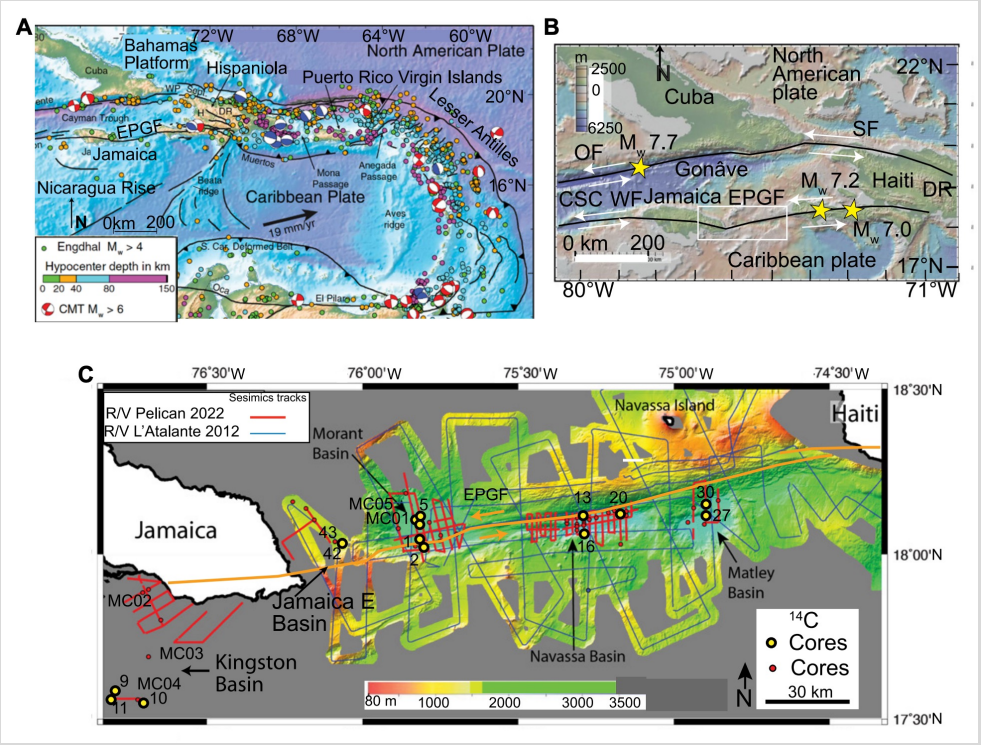


Lab study that integrates geophysics and soft matter physics for forecasting slope failure

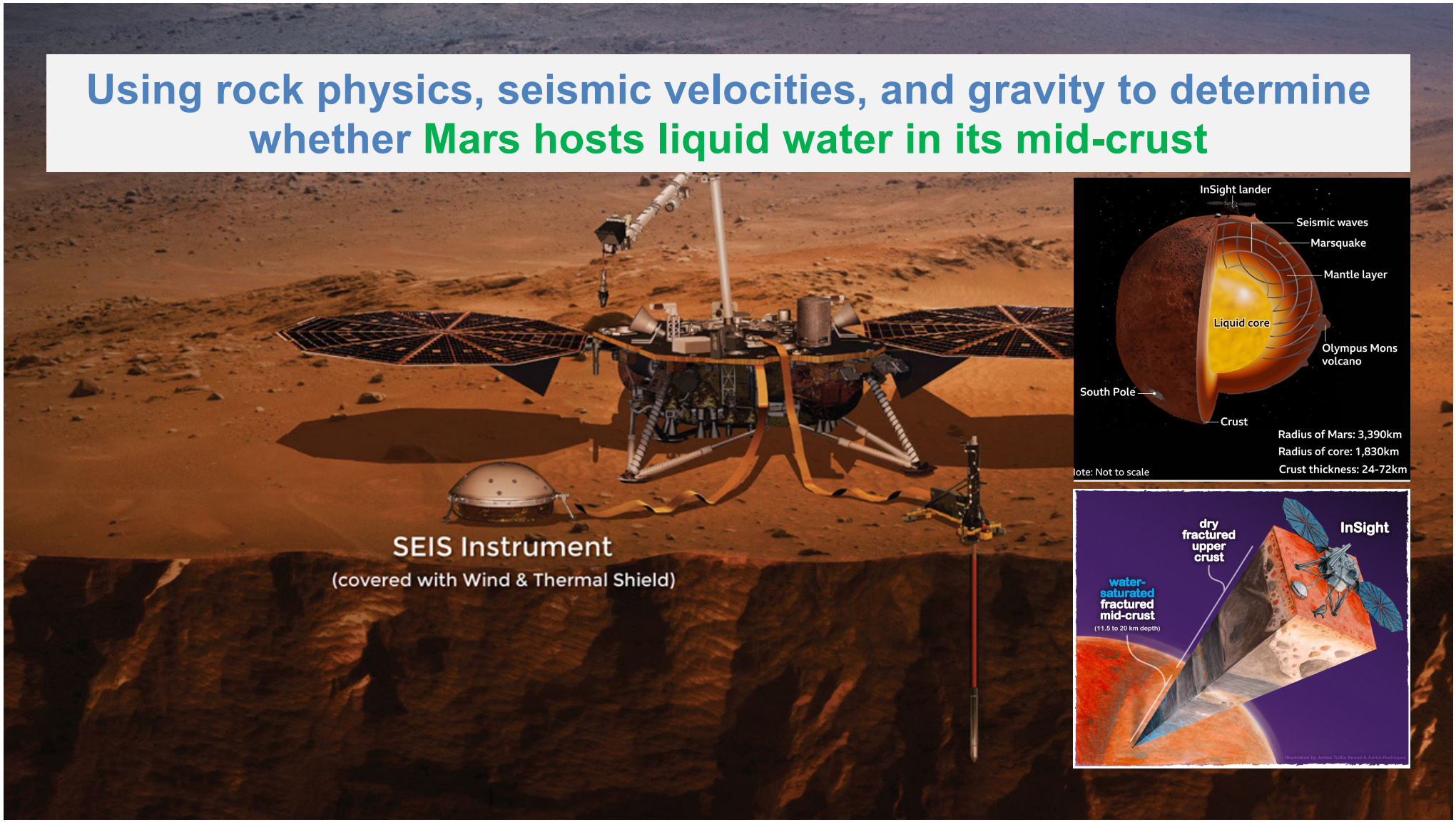


Members of STRPL on a cruise in the Caribbean Sea

How do rheology and inherited crustal structures influence the evolution and seismicity of paired strike-slip system?



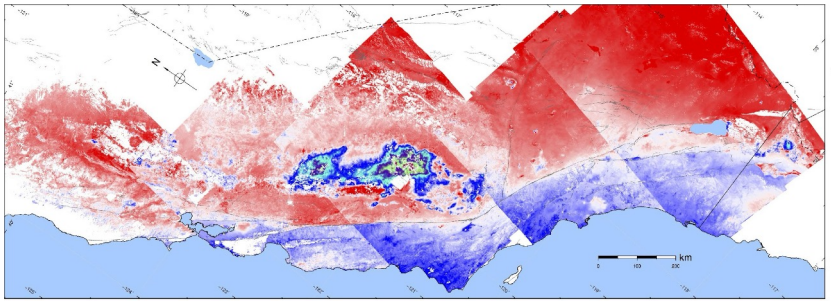
Using rock physics, seismic velocities, and gravity to determine whether Mars hosts liquid water in its mid-crust

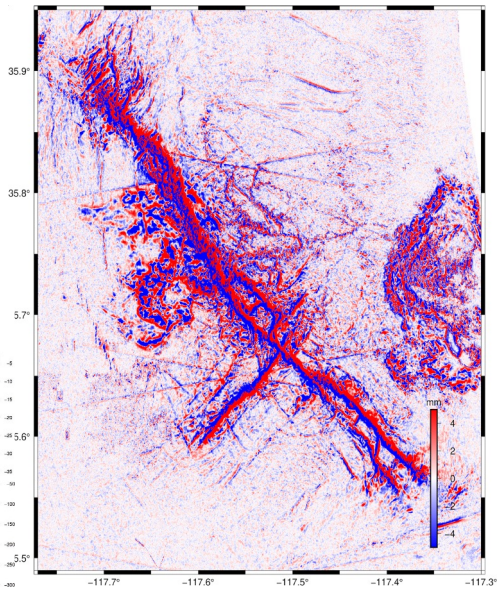


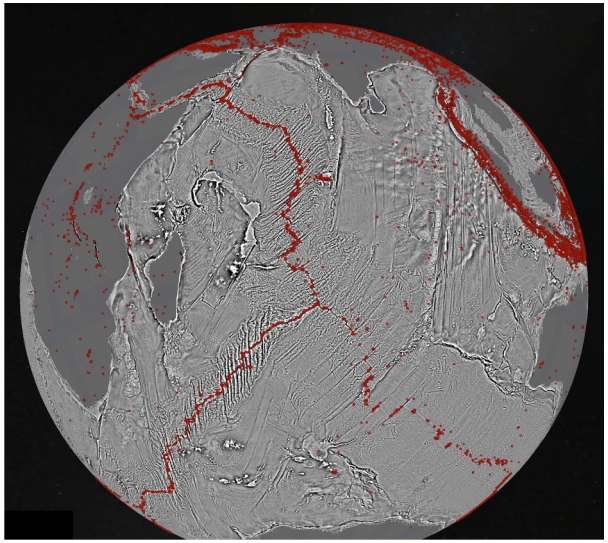
Geodesy

Adrian Borsa

- Earthquake Cycle – GNSS and InSAR
- Hydrogeodesy and Atmospheric/Climate







- Seafloor Geodesy at Subduction Zones
- Marine Gravity from Satellite Altimetry

Geodesy Field Surveys

2012

2008

2008

2022

2018

SIO/SDSU Field Trip
November 2019

The Geophysics Graduate Program

Dave May

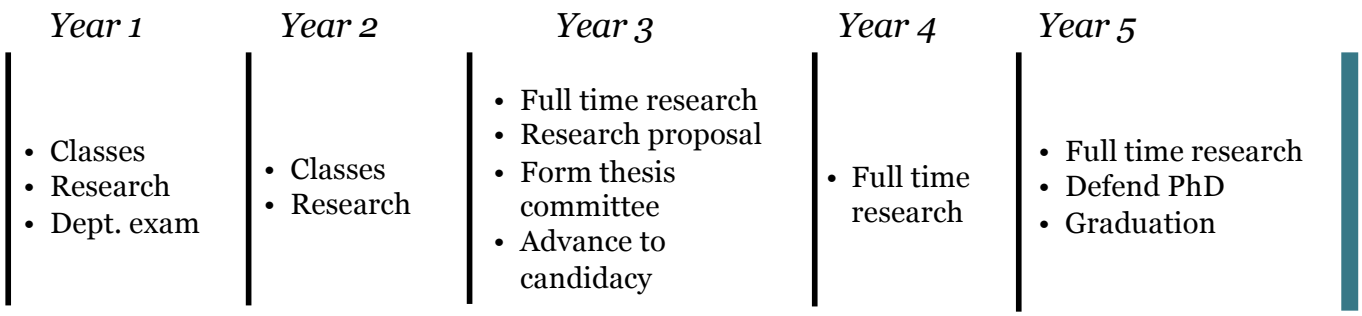
Graduate Program in Geophysics

Scripps Institution of Oceanography

Agenda

1. Geophysics PhD Timeline
2. First year courses
3. PhD Application Information

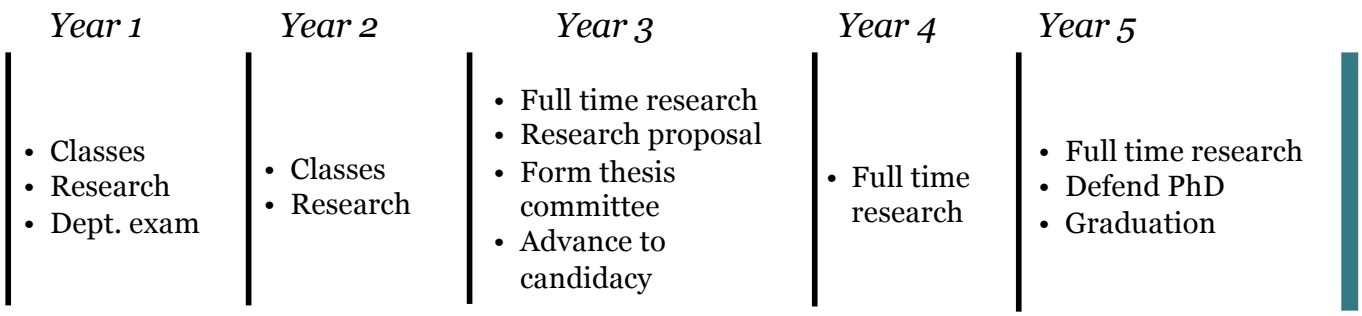
PhD Timeline



You are expected to graduate at the end of year 5

- In all years: You will enroll in 14 units (classes + research)
- Major milestones
  - End of year 1: Pass the Departmental exam
  - End of year 3: Advance to candidacy
  - End of year 5: Submit and defend your PhD
- More information can be found in the SIO PhD student handbook https://scripps.ucsd.edu/education/current/handbooks

PhD Timeline



You are expected to graduate at the end of year 5

Specifics of Year 1

- Consult with Guidance Committee (dept. committee + mentor) on what courses to take and when.
- Take classes, learn how to conduct research, commence research
- Sit the Departmental Exam
  - Written component: June
  - Oral component: End of summer

First year courses: Foundational + Electives

- Geophysical Research Skills I
- Geophysical Data Analysis I
- Physics of Earth Materials
- Practical Partial Differential Equations
  - Introduction to scientific computing

- Geophysical Research Skills II
- Geophysical Data Analysis II
  - Introduction to Seismology
  - Space Geodesy

- Geophysical Research Skills III
- Geodynamics
  - Plate Tectonics in Practice
  - Satellite Remote Sensing
  - Inverse Theory

Foundational courses
(Content covered in the departmental exam)

Electives

Your support system

GP Curricular Group Coordinator

Matthias Morzfeld

Departmental Committee

Alice Gabriel
algabriel@ucsd.edu

Steve Constable
sconstable@ucsd.edu

Wenyuan Fan
wenyuanfan@ucsd.edu

Your mentor

- Meets with you frequently throughout the year
- Helps with choosing classes (together with mentor)
- Coordinates GP Departmental Exam
- General resource for all things 1st-year grad school

Departmental Committee + Your mentor = Your Guidance Committee

Studying Geophysics at Scripps

- We provide a structured curriculum to provide foundational knowledge in geophysics
- You will have access to a broad range of specialized and interdisciplinary courses as needed for your research interests
- You can take advantage of field and/or sea-going projects, great computational resources, etc.
- The size of Scripps faculty means there is something for everyone, and a huge diversity of potential colleagues and collaborators and research opportunities for you.
- If you wish to join the Institute of Geophysics and Planetary Physics:
  - Graduate school applications closes on **December 04, 2024**
  - Explore the Geophysics pages here and contact a potential PhD mentor.

IGPP

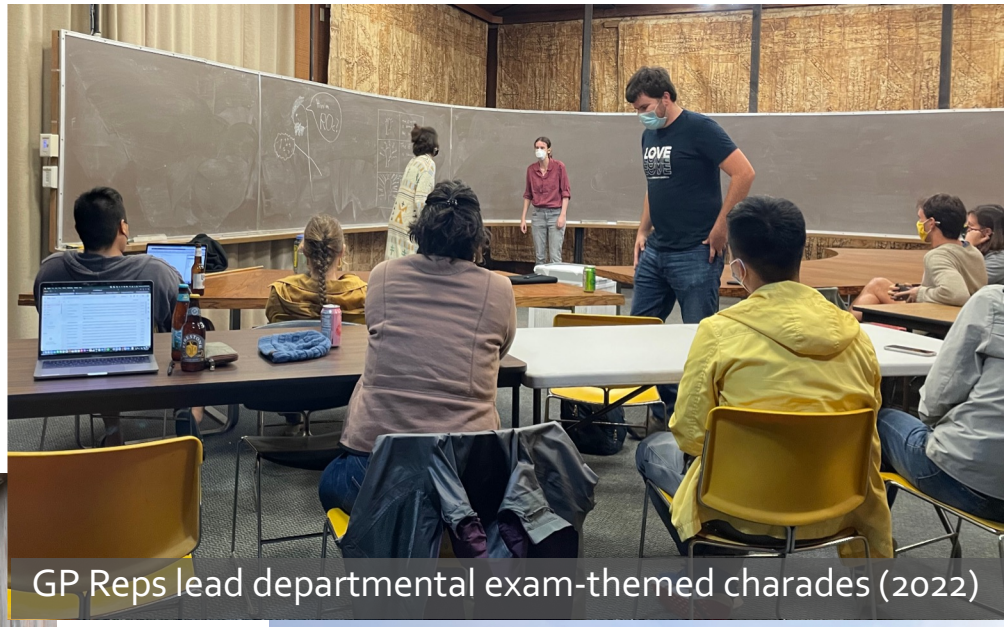
The Student Experience

Madeleine Kerr


Geophysics Student Experience

Geophysics graduate student body

- SIO is ~70 incoming PhDs / yr
- ~45 geophysics graduate students
  - ~10 incoming students/yr


GP Reps lead departmental exam-themed charades (2022)


The entire IGPP !! (2023)


The Morzfeld group in Germany at a workshop (2024)

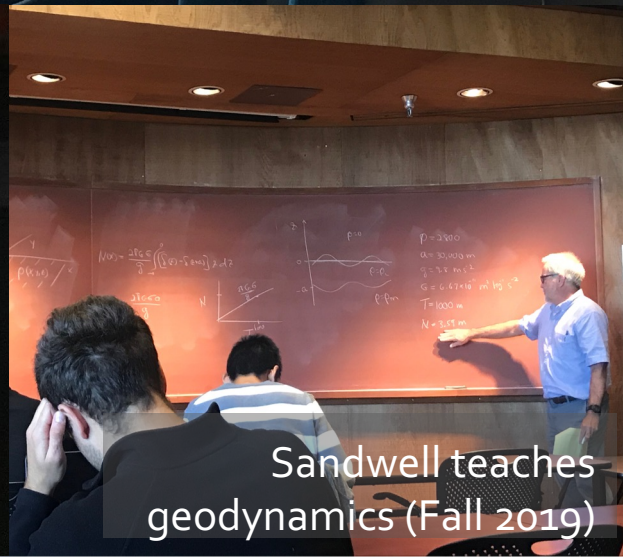
Student experience: IGPP Activities

- The Keller - GP 1st year office
- Monday morning coffee
- Wednesday IGPP Tea
- Mock oral exams
- IGPP Scavenger Hunt
- GP camping trip
- Weekly technical seminars & student lunches
- Create your own!


The fall equinox Munk alignment (2021)


The Keller (1st year offices)


IGPP Scavenger Hunt (2024)


Sandwell teaches geodynamics (Fall 2019)

Building Community at Scripps

- Graduate and Professional Student Association (GPSA)
- SIO Graduate Student Council (SGSC)
- UAW 4811 @ SIO
- Geophysics department opportunities
  - Faculty hiring
  - Curriculum review
  - GP reps
  - SciChat
- Peer mentors
- Scripps opportunities
  - DEI Fellows
  - SIO Committees
  - Student groups (e.g. Queer@Scripps, SCOPE)

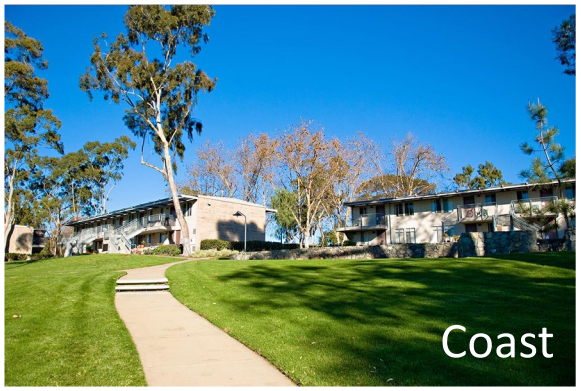
SGSC Dia de los Muertos altar

Community Engagement Fellows (2021-22)

Fieldwork & research cruises

Living in San Diego

- Rent varies by neighborhood: $800-$2300 based on neighborhood, roommates/etc
  - SIO Housing Listserv
  - Facebook groups
- Graduate student housing
  - Graduate student housing waitlist
  - ranges from $954-2300 S.O. room
  - mean ~$1100-$1300
- Transportation
  - The trolley!
  - Buses and shuttles
  - Biking
  - Driving



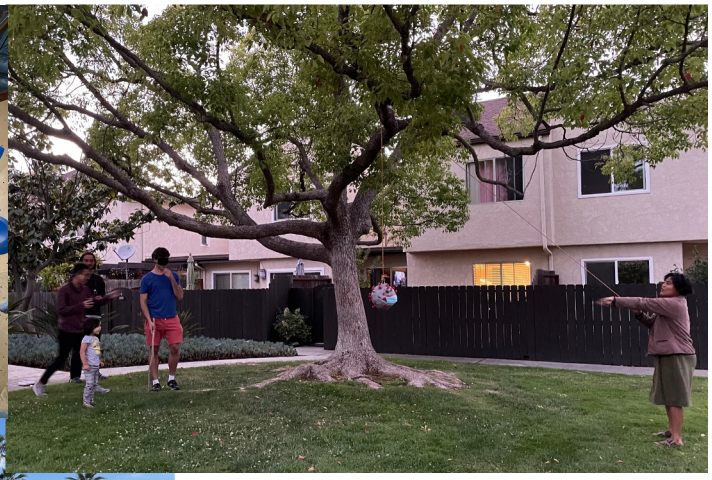
commuting

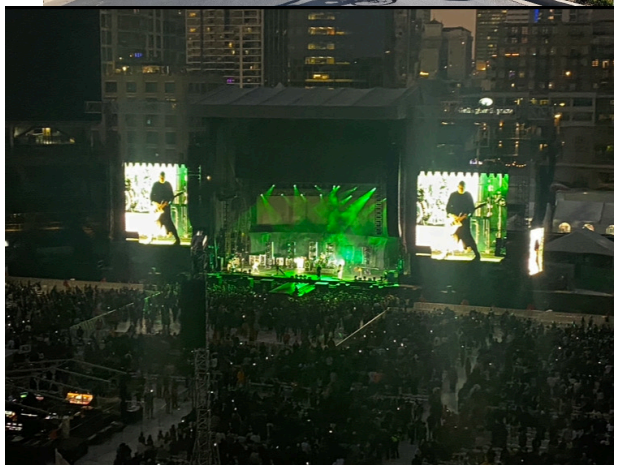
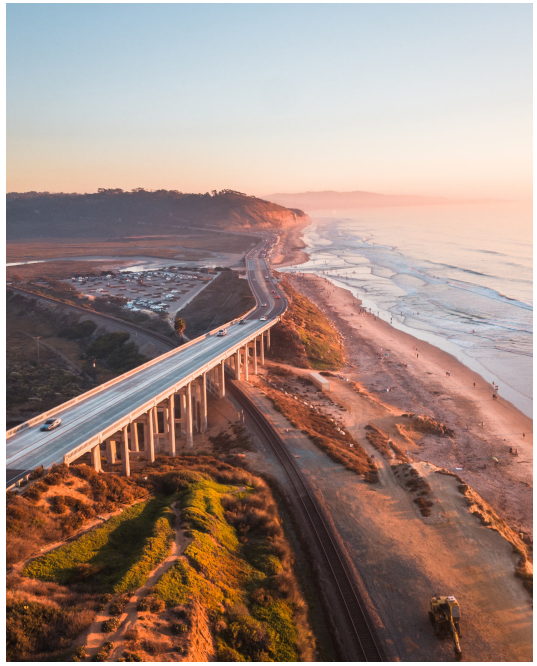
Life at SIO

- Best ocean view!
- Plenty of surfing, beach walks, hiking, rock climbing, cycling, etc.
- Lots of cool, interesting people to connect with
- friends!!

Life in San Diego

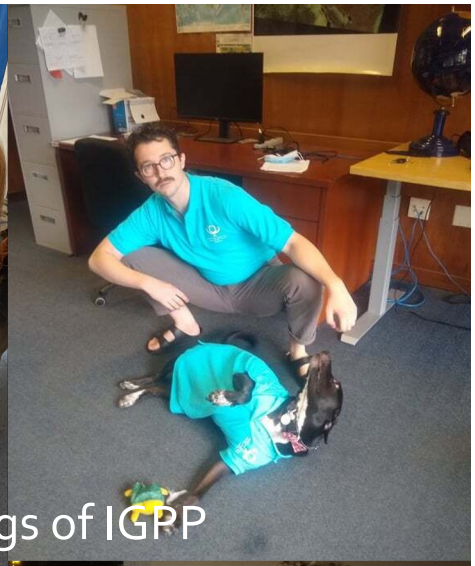
- Great weather, plenty of outdoor activities
- Lots of good food, music
- Beaches
- Safe and convenient place to live

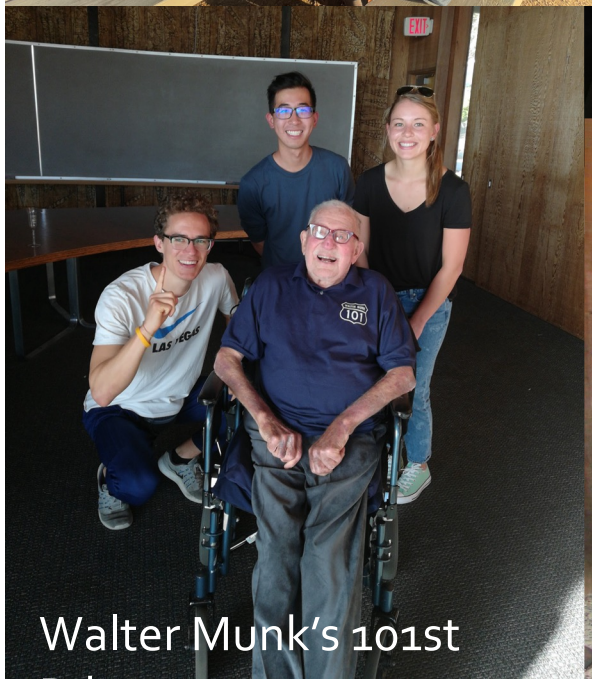



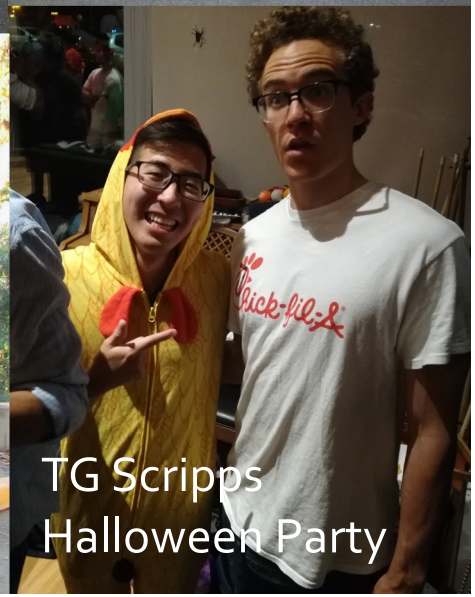

IGPP Tea Time


First Years celebrate passing exams


Good dogs of IGPP


Walter Munk's 101st


Halloween at IGPP


TG Scripps Halloween Party

Q&A

- You can drop questions into the Zoom chat
- You can raise a virtual Zoom hand
- You can email questions to Adrian (aborsa@ucsd.edu)

Some of us will stay until all questions are answered. We will email everyone 1) a summary of your questions and our answers and 2) streamlined instructions for applying to our program.