UC San Diego | SCRIPPS INSTITUTION OF OCEANOGRAPHY

# PhD and MS Info Session

## Climate, Ocean, Atmosphere Program (COAP)

November 15, 2023

# Organizers

Dr. Joel Norris
Professor (COAP director)

Dr. Ian Eisenman
Professor (PO)

Dr. Nick Lutsko
Asst. Professor (CS)

Dr. Mark Merrifield
Professor (AOS)

Dr. Kim Prather
Professor (CS)

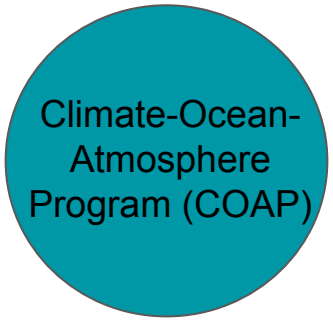
# Outline

1. Introduction to the Climate, Ocean, and Atmosphere Program (COAP)
    a. Curricular groups within COAP: Applied Ocean Sciences, Climate Sciences, Physical Oceanography
    b. Research done within COAP curricular groups
2. Demystifying the admissions process
3. Curricular Groups and COAP-wide curriculum requirements (MS & PhD)
4. Curricular Group Breakout sessions (faculty, research themes, courses)
    a. Applied Ocean Sciences (AOS)
    b. Climate Scienses (CS)
    c. Physical Oceanography (PO)
5. Q&A

# Admissions Process

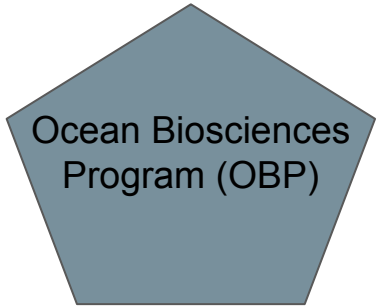
There are 3 academic programs at Scripps for MS and PhD

And there are 8 curricular groups (CGs) within these




Applied Ocean Science (AOS)
Climate Sciences (CS)
Physical Oceanography (PO)


Geosciences (GS)
Marine Chem & Geochem (MC&G)
Geophysics (GP)




Biological Oceanography (BO)
Marine Biology (MB)

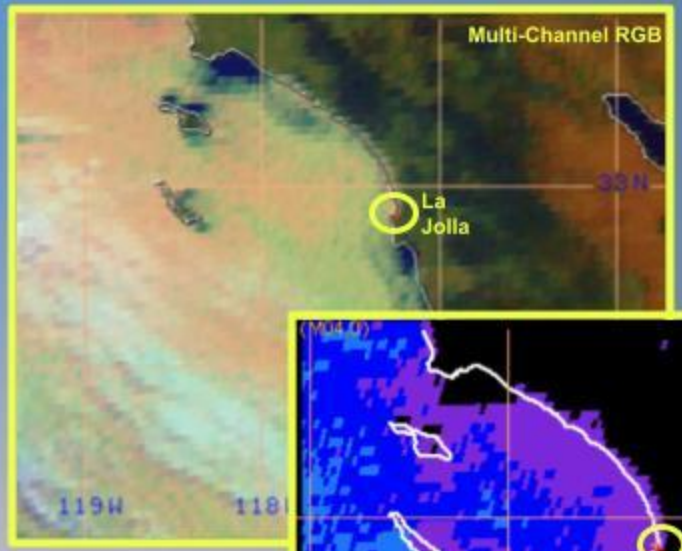
# Introduction to COAP

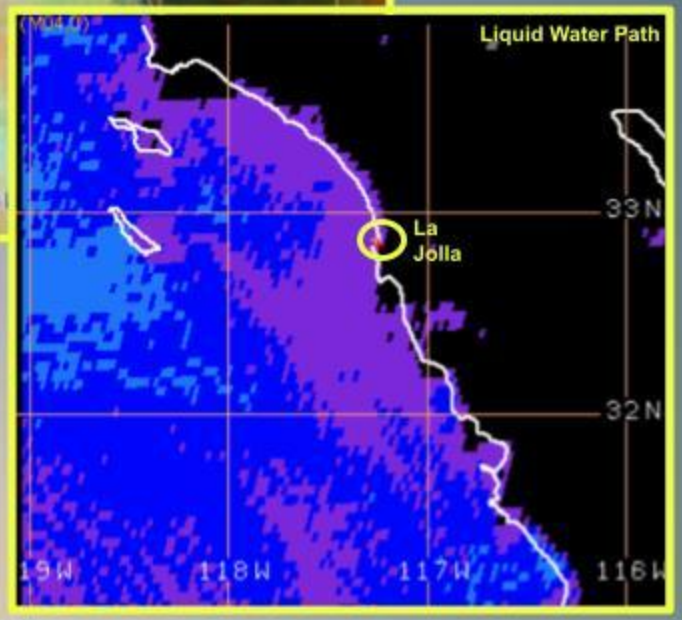
- Applied Ocean Sciences (AOS)
- Climate Sciences (CS)
- Physical Oceanography (PO)

Common features:

- 3 person pre-Qualifying guidance committee
- Departmental Exam (written & oral) at end of Year 1 (Ph.D. only)
- Masters Thesis (M.S. only)
- Qualifying exam in Year 3 (Ph.D. only)
- Course requirements differ in each curricular group

# Specifics of Each Curricular Group in Breakouts




# Eastern Pacific Cloud Aerosol Precipitation Experiment (EPCAPE)

## February 2023 through February 2024

### Scientific Objectives:

- Characterize aerosols and clouds
- Measure cloud radiative fluxes
- Quantify aerosol-cloud interactions

### Frequent Coastal Cloud Coverage

### Prior Aerosol Studies at La Jolla:

- Hawkins and Russell, 2010, *Atmos. Env.*
- S. Liu et al., 2011, *Atmos. Chem. Phys.*
- Day et al., 2011, *Atmos. Env.*
- Modini et al., 2015, *JGR Atmos.*
- Sanchez et al., 2016, *JGR Atmos.*

*Lynn Russell Aerosol Research Group 2023*

# Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM)

Objective: "Drive a transformative shift in the scientific and public understanding of the role of the vast Southern Ocean in climate change and biogeochemistry"

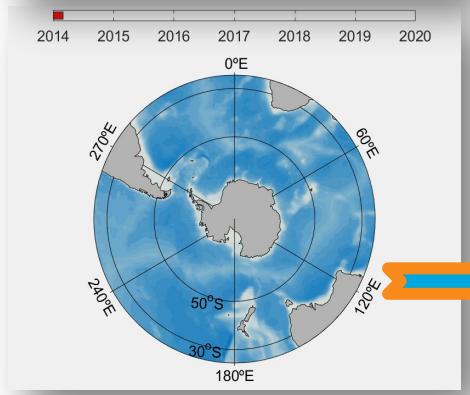
Institutions: Princeton, SIO, UW, U. Arizona, MBARI

SIO faculty: Matt Mazloff, Sarah Gille, Lynne Talley

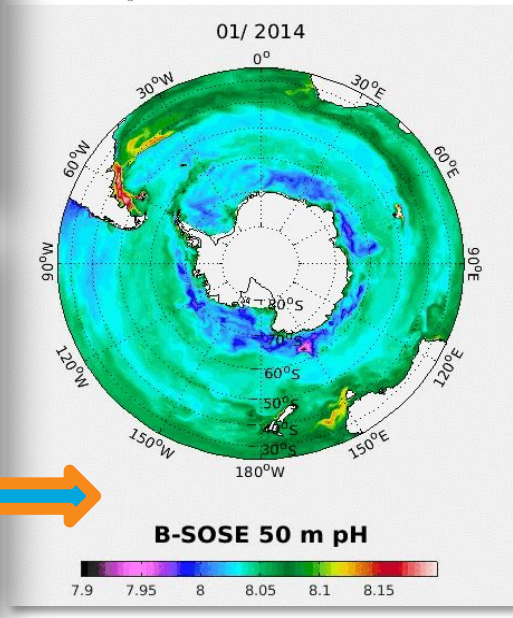
SIO roles: float deployments/data analysis, coupled biogeochemical and physical data assimilation

SIO PhD students: 6 completed (PO, CS, AOS, MC)
2 in progress (PO, CS)
(+ 2 in progress in closely related GO-BGC program)

- Continuous Southern Ocean biogeochemical and physical observations by deploying a robotic observing system (Argo-equivalent floats); float data analysis
- Using these observational data, analyze and improve Earth system models and make better future projections.
- Reconstruct budgets of micronutrients, macronutrients, pH, carbon, oxygen, heat, freshwater, momentum, and energy
- Facilitate understanding of the variability and sensitivity of ocean acidification, carbon content, fertility, oxygen minimum zones, freshening, and warming


B-SOSE
Biogeochemical Southern Ocean State Estimate



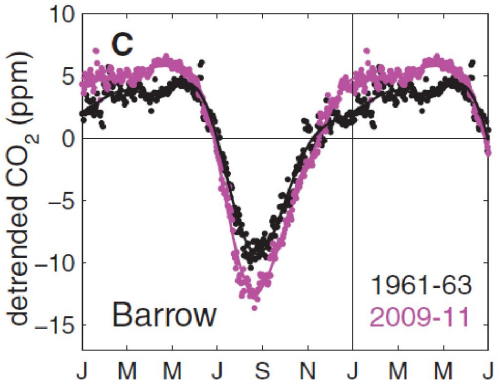

SOCCOM floats superimposed on B-SOSE

# Ralph Keeling's research group

**Major research goals:**
(1) Measuring trends in atmospheric $O_2$ and $CO_2$ to assess emissions and understand carbon-climate feedbacks.
(2) Developing novel instrumentation for measuring changes in atmospheric composition
(3) Global biogeochemical modelling.

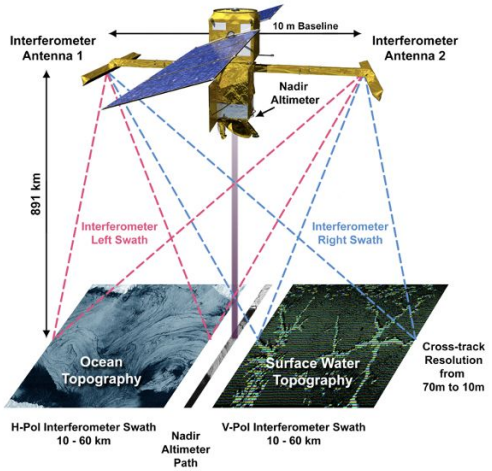
Trends, gradients, and variability in $O_2$ and $CO_2$

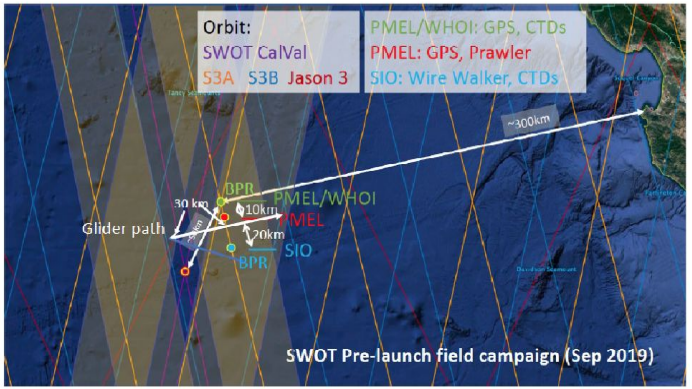
$CO_2$ cycle growing larger with time

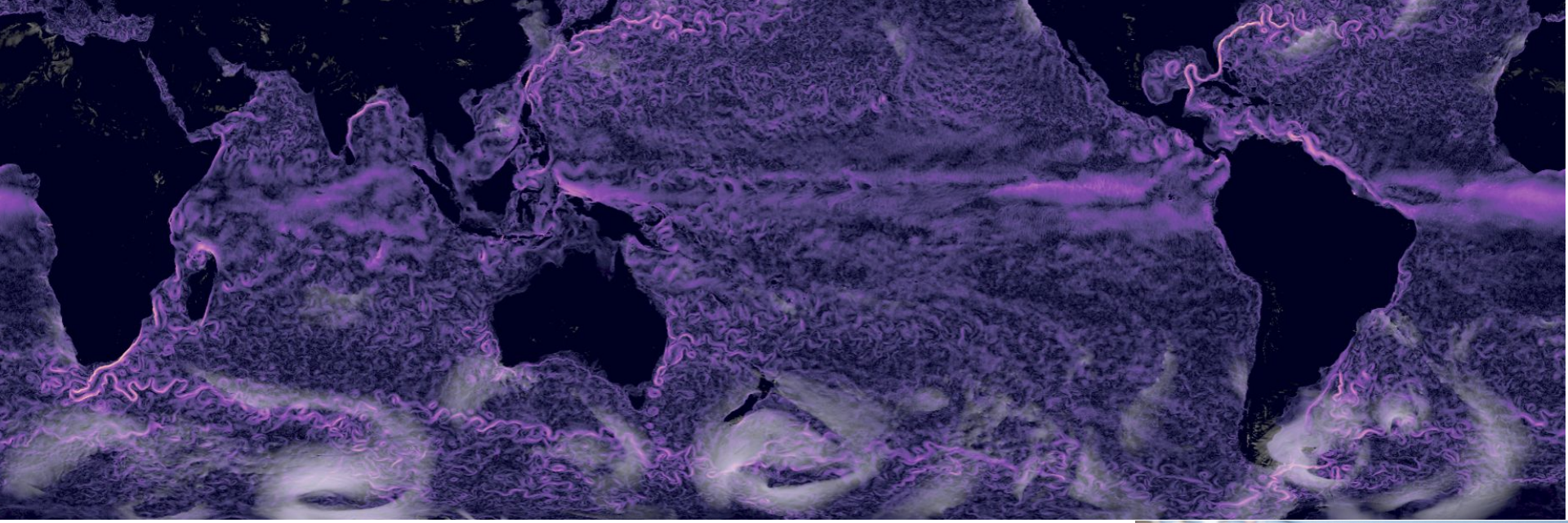


# How do small-scale processes influence large-scale climate? (Sarah Gille, Matt Mazloff, Bruce Cornuelle)

- The Surface Water and Ocean Topography (SWOT) satellite launch in December 2024 and is just returning its first data.
- It measures sea surface height in 100-km wide swaths, with ~5-10 km resolution, providing a high-resolution view of the sea surface.
- Through data analysis, modeling, and assimilation of data into models, we ask how small scales modify large-scale (climate-scale) processes. Can we use high-resolution SWOT data to expand our understanding of ocean physics?





Impact of fine ocean scales on air-sea fluxes using a grounbreaking high-resolution simulation ran at NASA Jet Propulsion Laboratory

# Measuring waves and turbulence in the ocean

Matthew Alford
Scripps Institution of Oceanography, UC San Diego

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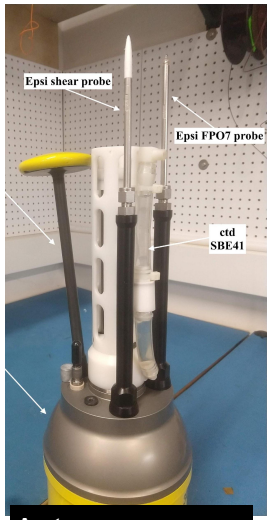
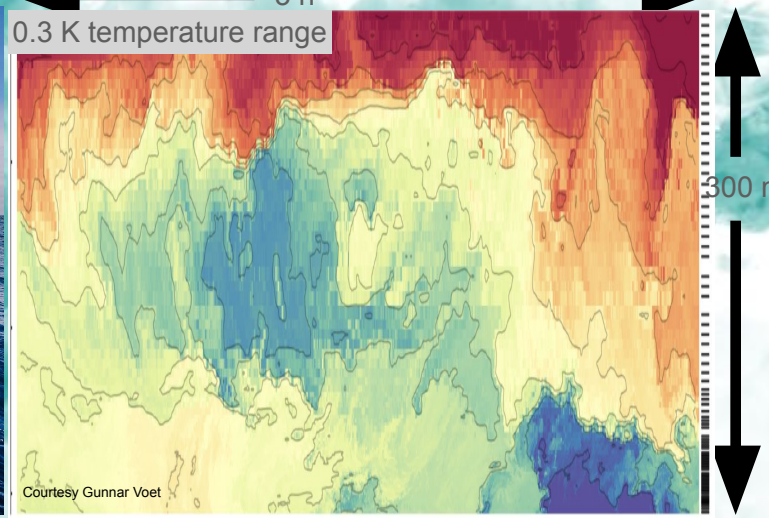
Specialized tools built at Scripps allow direct measurements of ocean mixing




Autonomous platforms such as Argo

High-speed winches for fast shipboard profiling

Breaking waves 2000 m below the sea




Skyscraper-sized deep-sea breaking waves set mixing patterns that modulate climate

Same physics as beach waves

Washington Monument

# Bring Ocean and Atmosphere Together (BOAT) Group


**PI: Xuanting Hao**

Assistant Professor

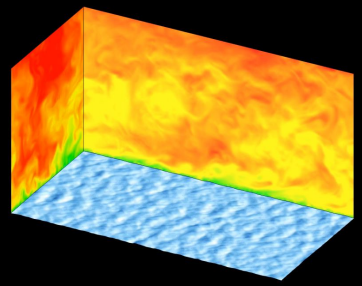
Scripps Institution of Oceanography &
Mechanical and Aerospace Engineering


## Members

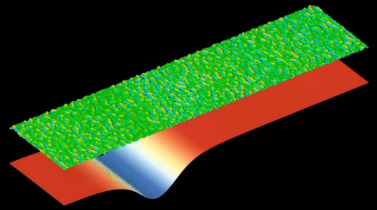
1 postdoc
1 doctoral student
3 undergraduate students
1 visiting scholar

## Research area

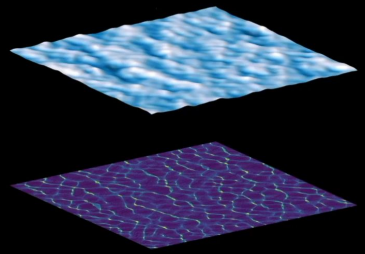
Air-sea interaction
Physical oceanography
Boundary-layer meteorology
Computational fluid dynamics



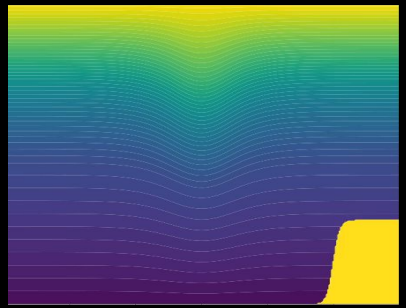
Wind-wave interaction



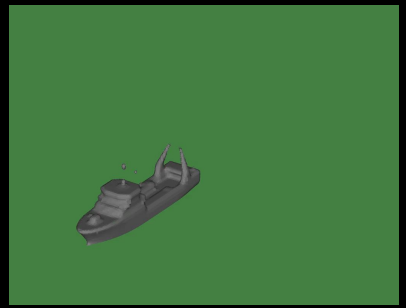
Internal wave signature



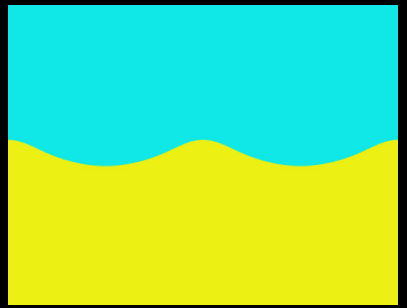
AI-based light simulation



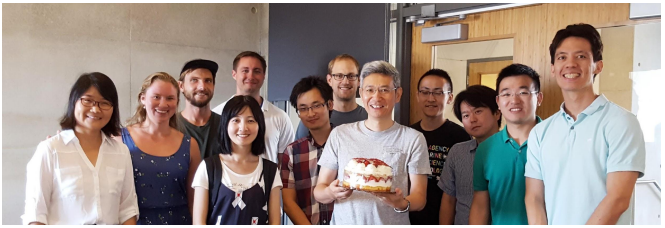
Shoaling internal wave



Ship wake



Breaking surface waves

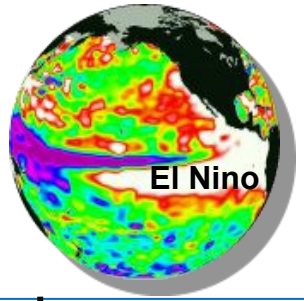


Xie Group

By studying historical climate variability, we probe **ocean-atmospheric processes** important for climate change.

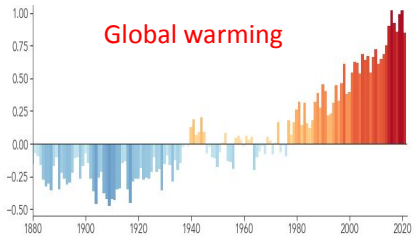
## Climate variability

El Nino, monsoon, drought, hurricanes, storm tracks




## Climate change

Ocean heat uptake, regional patterns, heatwaves

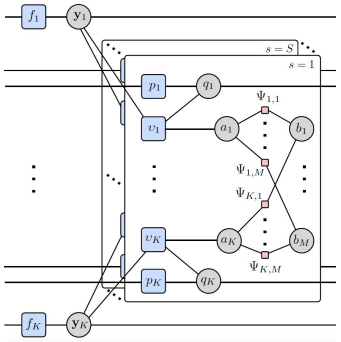



## Climate processes & dynamics

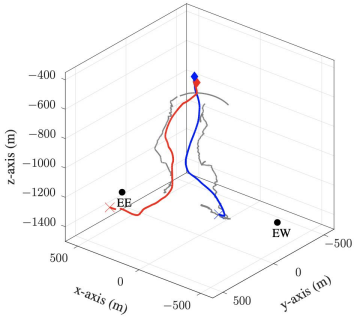
## □ prediction

# Situational Awareness Lab: Florian Meyer (flmeyer@ucsd.edu)

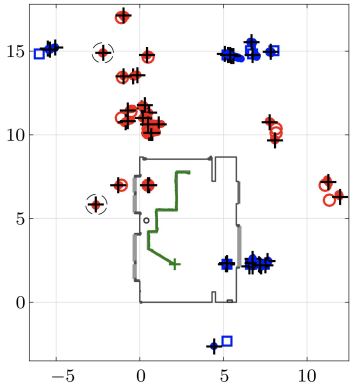
- **Research fields:** signal processing, parameter estimation, marine robotics
- **Research problems:** multiobject tracking, underwater localization, geoacoustic inversion, indoor localization and mapping



Graph-based Signal Processing

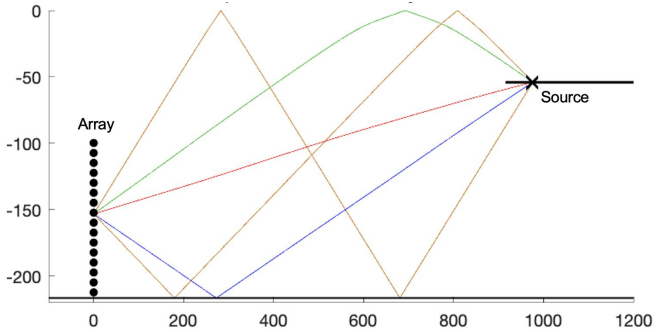



Whale Tracking



Indoor Localization & Mapping

Marine Robotics

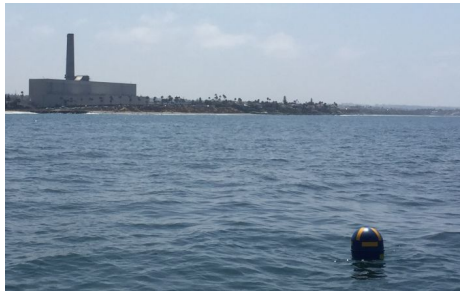



Shallow Water Source Localization

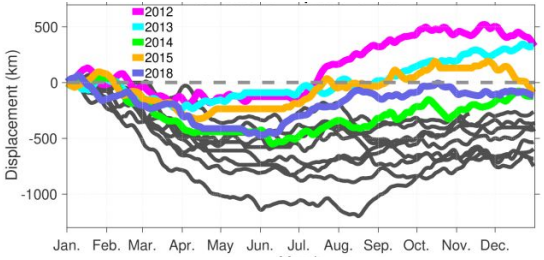
# Send "Ocean Time Series" lab

**Mooring-based studies of circulation and physical processes controlling biogeochemical and ecosystem changes**

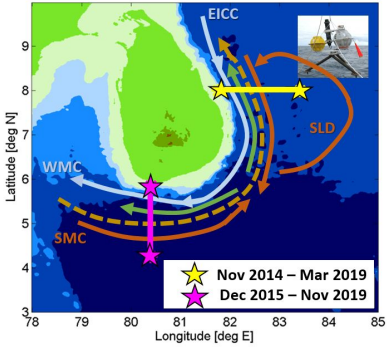
**Very shallow water** (e.g. ocean acidification)



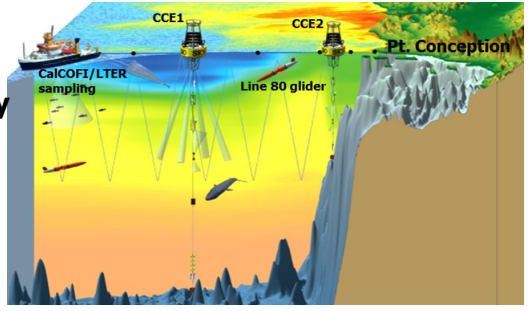
**Shelf** (here poleward advection in different years)



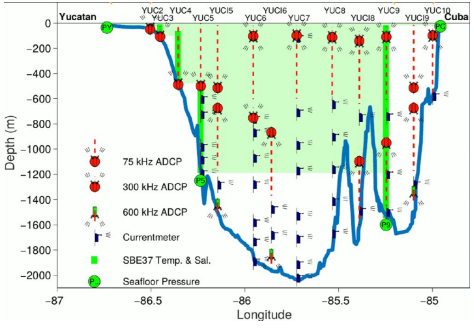

**Western boundary currents**



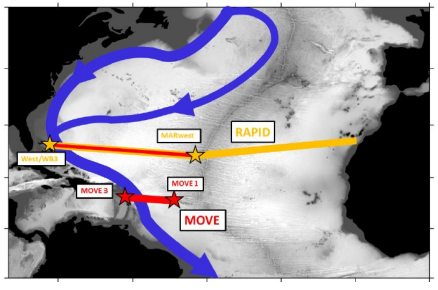

**Eastern boundary currents** (here Southern California)



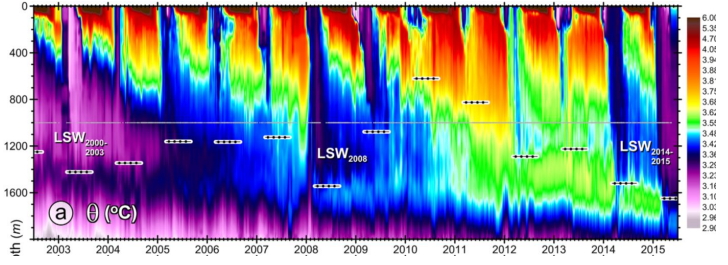

**Straits and Passages**




**Thermohaline circulation**




**Global water mass formation** (here Labrador Sea)



# Prof. Amato Evan

My lab studies the physics of dust storms and their effects on weather and climate. We are also working to develop dust forecasts that minimize exposure and adverse health impacts.

Desert east of SIO and the location of our field site (red)

Collecting particles for analysis with a scanning electron microscope

Working in a dust storm

# SIO General Admission Requirements

Candidates for admission should have a bachelor's (BS) or master's degree in one of the physical, biological, or earth sciences; in some cases a degree in mathematics or engineering science is accepted.

A scholastic average of B or better (3.0) in upper-division courses, or prior graduate study, is required.

The student's preparation should include:

- Mathematics through differential and integral calculus.
- Physics, one year with laboratory (the course should stress the fundamentals of mechanics, electricity, magnetism, optics, and thermodynamics, and should use calculus in its exposition).
- Chemistry, one year with laboratory.
- An additional year of physics, chemistry, or mathematics.

GRE is not required

# COAP (AOS/CS/PO) Admission Requirements

AOS: strong background in physical science, engineering science, or mathematics. Three years of physics or applicable engineering and three years of mathematics at college level are expected.

CS: Students are admissible if they satisfy the requirements of the physical oceanography, geophysics, or marine chemistry and geochemistry curricular programs.

PO: A major in a physical science, including three years of physics and mathematics, is required.

# Admissions Process

1. Apply to SIO program(s)
   **Due: Dec 6, 2023**

2. SIO department staff sort applications. *All applications are accessible to all SIO faculty members*

3. Individual faculty members read, review, and rate applications. Each file is reviewed by multiple faculty.

4. CG faculty meet (mid/late Jan) to decide:
   a. invitations to open house
   b. admissions

5. Open House (mid-late Feb)

6. Final admissions decisions (typically early April)

# Admissions Process

★ Successful applicants often make contact with potential faculty advisors outside of the formal application process

→ this can happen at any time, but ideally before the application deadline

★ Students are admitted to the SIO program, not an individual faculty member's lab

→ but to be admitted, students are often sponsored (financially) by an individual faculty member (stipend+tuition). Faculty have to have $

→ other financial mechanisms: student fellowships, department funding (limited)

→ students are not admitted on TAships (but there are TA opportunities after 1st year)

# Admissions Process

## Students are encouraged to:

Contact faculty

Develop your application statement (next slide)

Seek fellowship opportunities

## Keep in mind:

Available positions and faculty funding are also major factors.

# Admissions Process

Criteria under consideration:

- ★ Academic preparation
- ★ Scholarly achievements, experience, and potential
- ★ Alignment with program - how well do your interests align with one or more faculty in the program to which you are applying?
- ★ Long-term goals, including evidence of engagement in long-term endeavors
- ★ Contributions to Diversity, Equity, and Inclusion

# Admissions Process

★ Some important qualities that many faculty look for in an applicant are not included as standard questions in the application

→ your essay is the best place to provide this information

→ what information are we talking about?

# Admissions Process

Writing a successful application essay.  We want to know about:

★ Your “distance traveled”

- Any challenges or hardships you have faced or overcome in the pursuit of education and/or research
- Opportunities in education and/or research that you have sought, even if these didn’t work out
- Evidence of your passion, motivation, and intent, even if you haven’t had many opportunities to gain experience in research up to this point

# Admissions Process

Writing a successful application essay.  We want to know about:

★ Your contributions to diversity, equity, and inclusion

- Community service
- Social justice
- Leadership roles
- Broadening opportunities for underrepresented groups
- Showing more than an awareness
- You may also speak about values and future goals

# Admissions Process

Writing a successful application essay.  We want to know about:

- ★ Your self-appraisal
  - Qualities that demonstrate an ability to learn from feedback and experiences
  - Description of personal strengths with examples
  - Realistic assessment of potential weaknesses and how you plan to grow

# Breakout session