High technology on the high seas: advances in global ocean science onboard UNOLS vessels

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Marine Physical Laboratory
Scripps Institution of Oceanography
U.C. San Diego

A career sciencing at sea: Drew Lucas

- First cruise: NBP McMurdo to Punta Arenas via Palmer station Jan/Feb 2000
- Scripps Oceanography technician (Shore Station program, 2001 – 2002)
- SIO M.Sc. (2005) and Ph.D. (2009)
- SIO Researcher (2013-2016)
- SIO and UCSD Dept. MAE Faculty (2017–)
- Director of the Multiscale Ocean Dynamics group (2024 –)

>500 days on UNOLS vessels – Revelle, Thompson, Ride, AE, Sproul, Blue Heron, New Horizon, Melville, Sikuliaq (Nov 2025)

The Multiscale Ocean Dynamics group

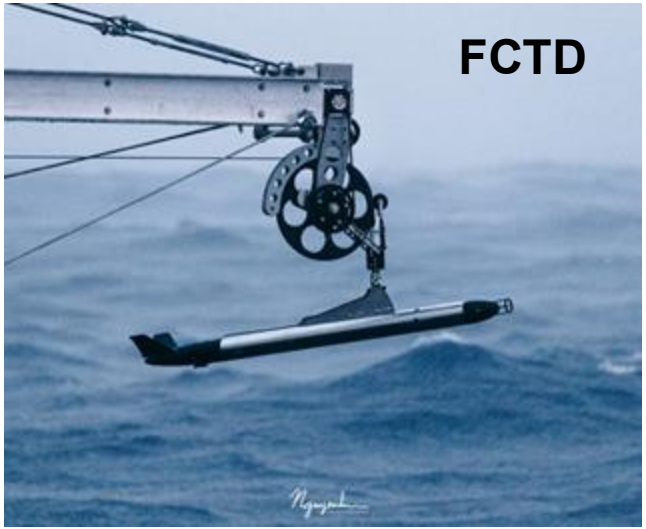
http://mod.ucsd.edu

People: Lucas (lead), Alford, MacKinnon, Voet, Waterhouse PIs (Pinkel Emeritus)
13 career staff, 3 Post docs, ~10 Grad students, tons of UG students

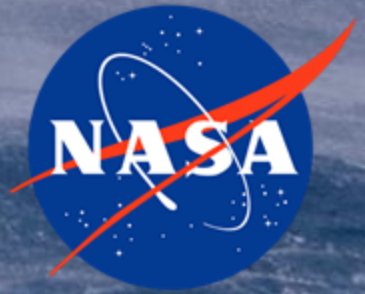
Focus: Observational physical oceanography with cutting edge tools

Toys: Shipboard profiling (Fast-CTD, EPSI), Wave-powered profiling (Wirewalker), Doppler Sonar (HDSS and PADS), moored systems

MOD
MULTISCALE OCEAN DYNAMICS
SCRIPPS INSTITUTION OF OCEANOGRAPHY // UC SAN DIEGO



Improving forecasts of the Southwest Monsoon: A decade of collaborative research



Improving forecasts of the Southwest Monsoon: A decade of UNOLS in the northern Indian Ocean

ASIRI 2013: Revelle from Colombo
ASIRI 2014: Revelle from Chennai
ASIRI 2015: Revelle from Chennai

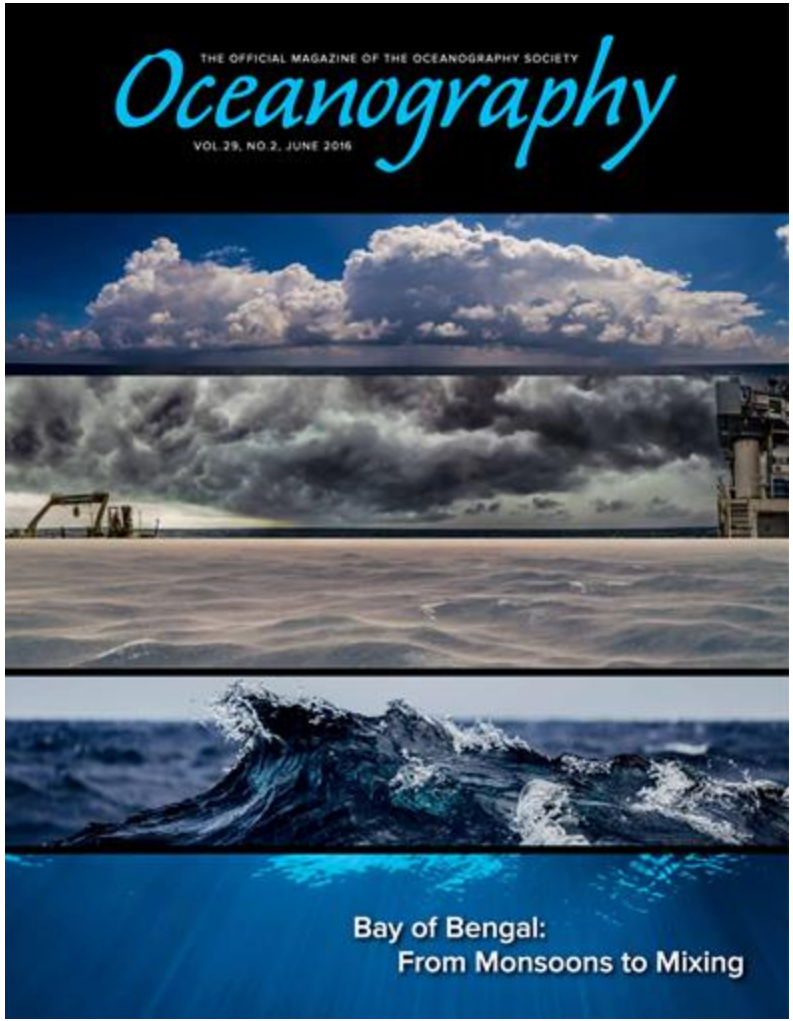
Miso-BoB 2018: Thompson from Chennai
Miso-BoB 2019: Ride from Chennai

EKAMSAT 2023: Revelle from Goa
EKAMSAT 2024: Thompson from Chennai
EKAMSAT 2025: Thompson from Phuket

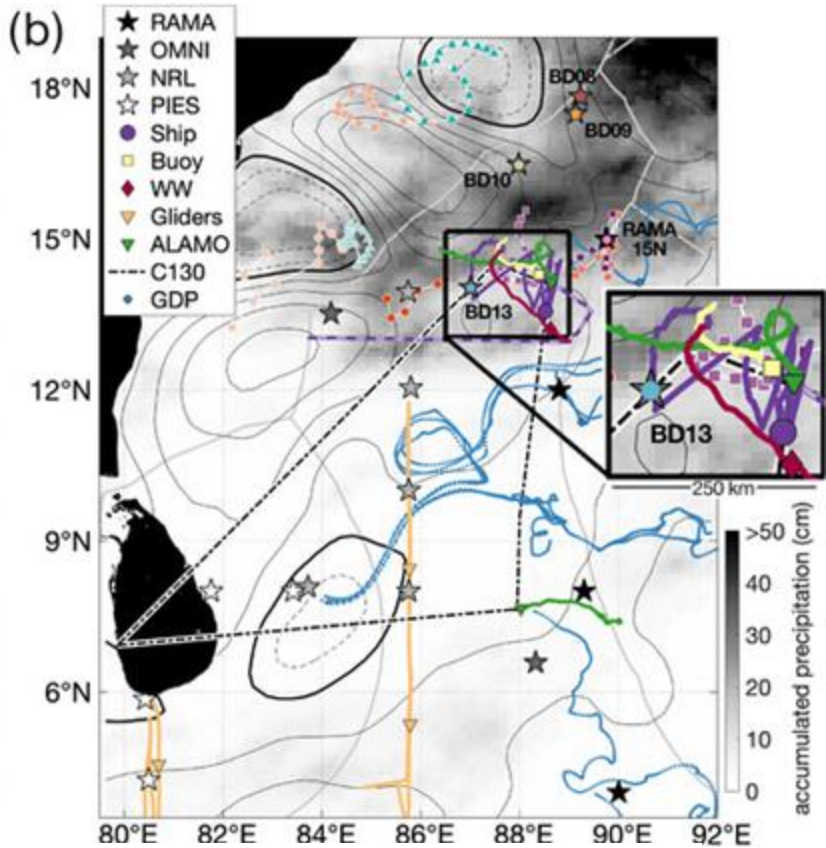
The Southwest Monsoon influences the **lives and livelihoods of nearly one-quarter of the world's population**, shaping food security, water availability, and economic stability across the region.

The ocean **plays a central role** in the formation, intensity, and timing of the monsoon.

This project focused on **building international collaboration, understanding the coupled ocean/atmosphere processes** that influence monsoon timing and intensity, and **developing high-resolution ocean and atmosphere measurements.**



Improving forecasts of the Southwest Monsoon



Shroyer, E., and Coauthors, 2021: Bay of Bengal Intraseasonal Oscillations and the 2018 Monsoon Onset. *Bull. Amer. Meteor. Soc.*, **102**, E1936–E1951, https://doi.org/10.1175/BAMS-D-20-0113.1.

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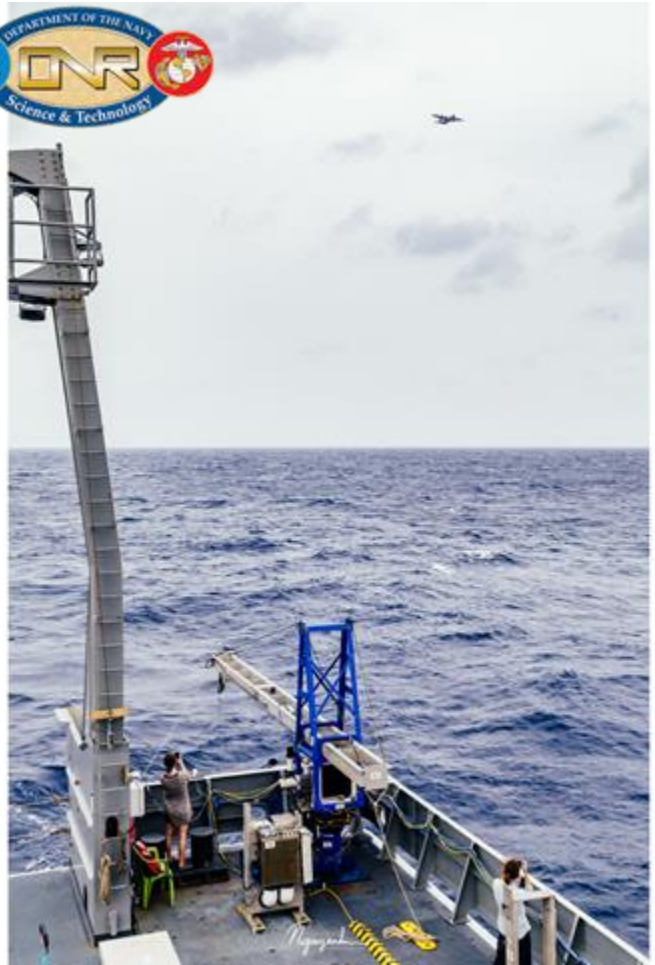

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Improving forecasts of the Southwest Monsoon: FCTD

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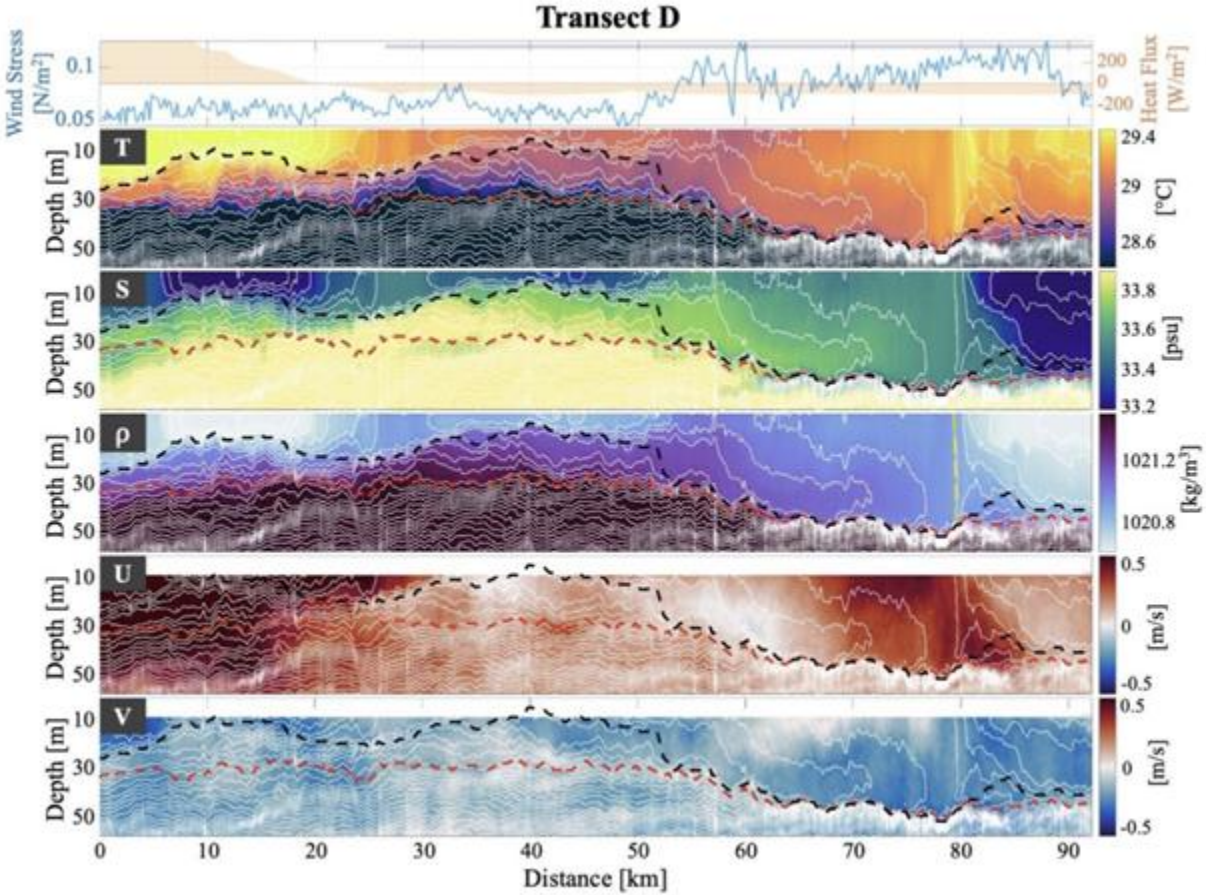

FCTD towed profiling:

Ship speed -> 2 - 4kn

Depth range -> 0 - 500 m

Vertical winching speed -> up to 5 m/s

Horizontal profile spacing ~200 m

McKie, T., Lucas, A. J., & MacKinnon, J.(2024). Submesoscale dynamics in the Bay of Bengal: Inversions and instabilities.Journal of Geophysical Research: Oceans,129, e2023JC020563

Improving forecasts of the Southwest Monsoon: Wirewalker

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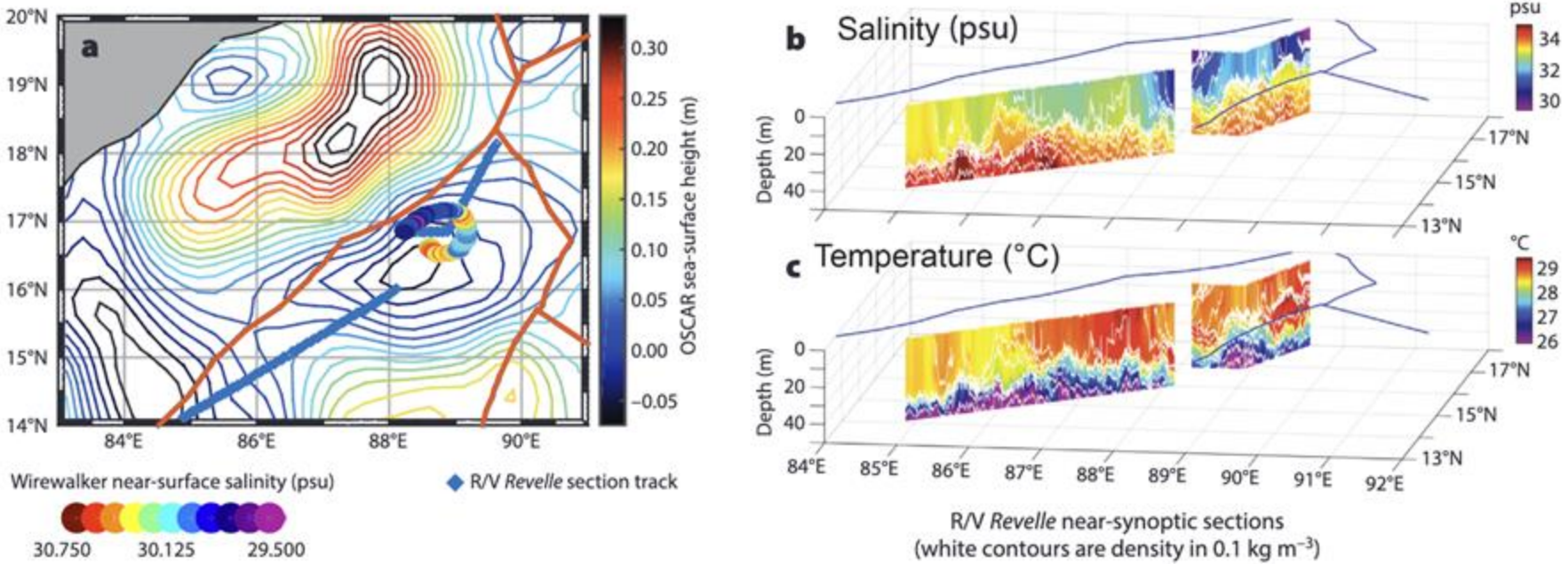

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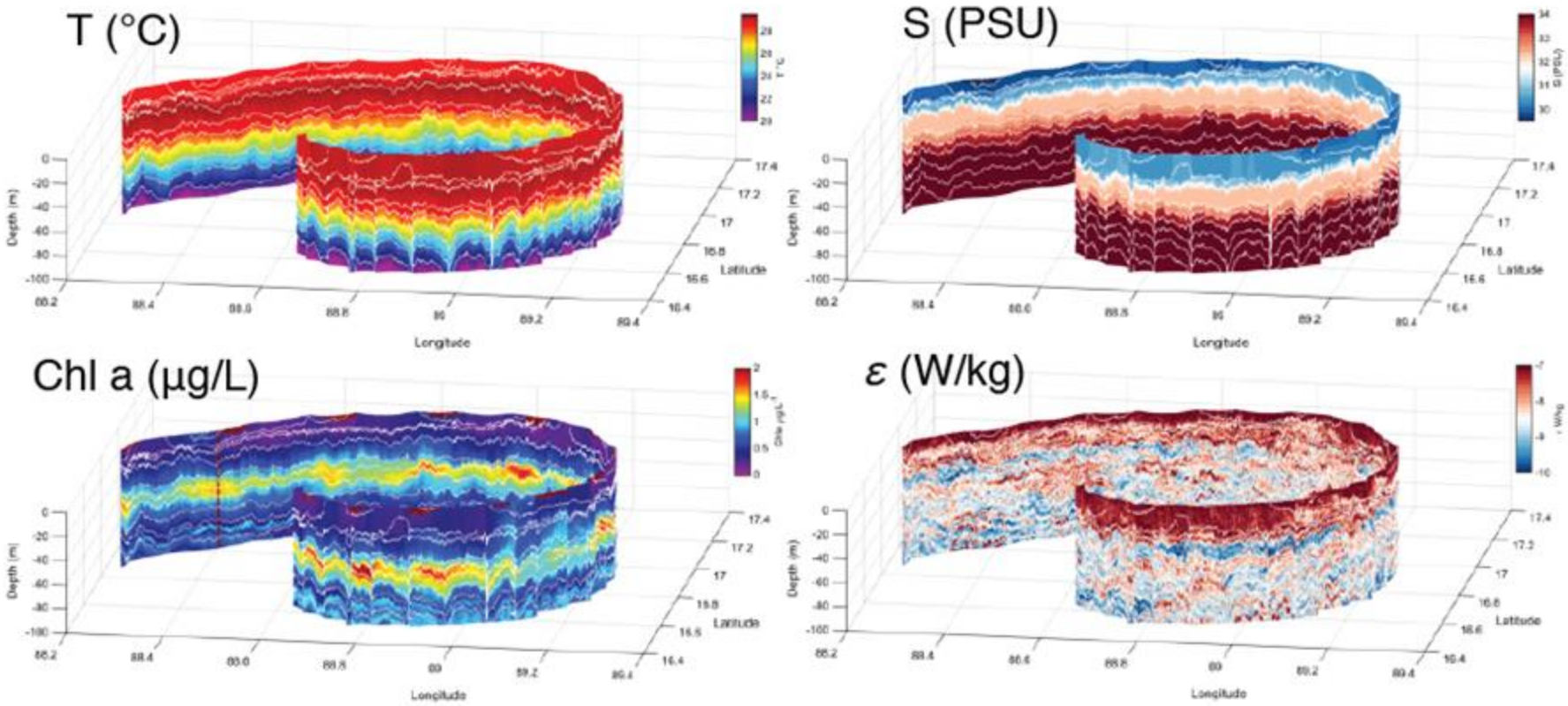

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Improving forecasts of the Southwest Monsoon: multi-asset operations

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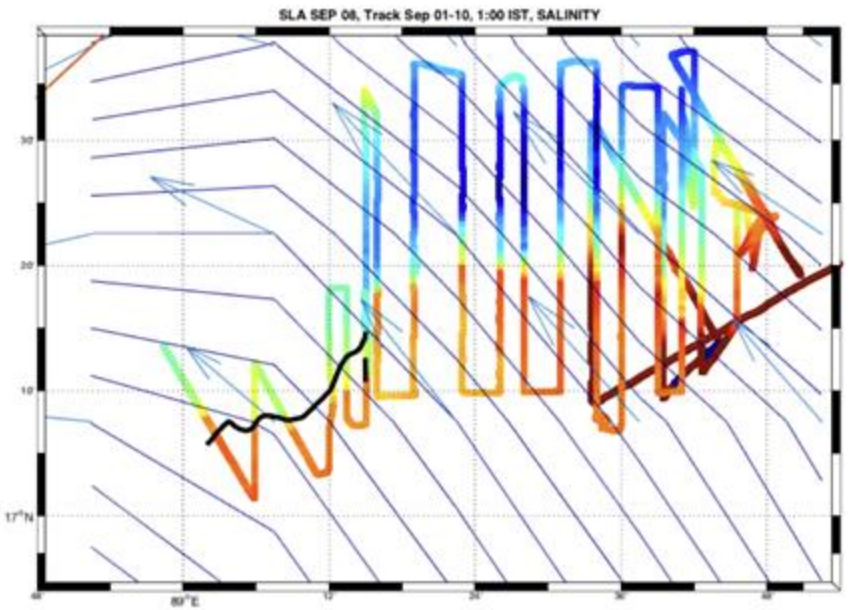

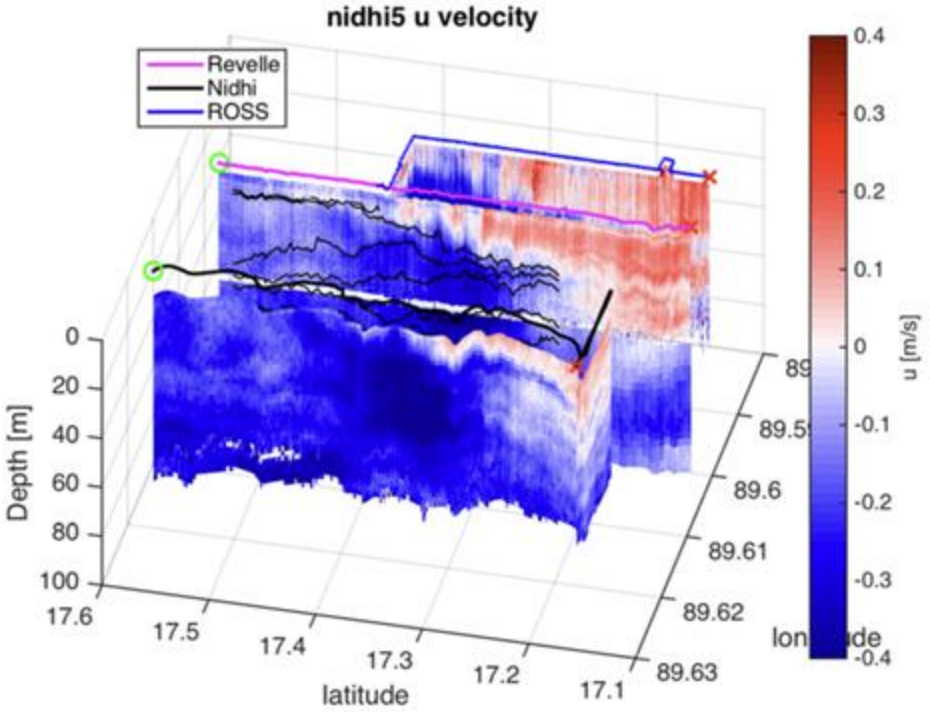

Improving forecasts of the Southwest Monsoon: international collaboration

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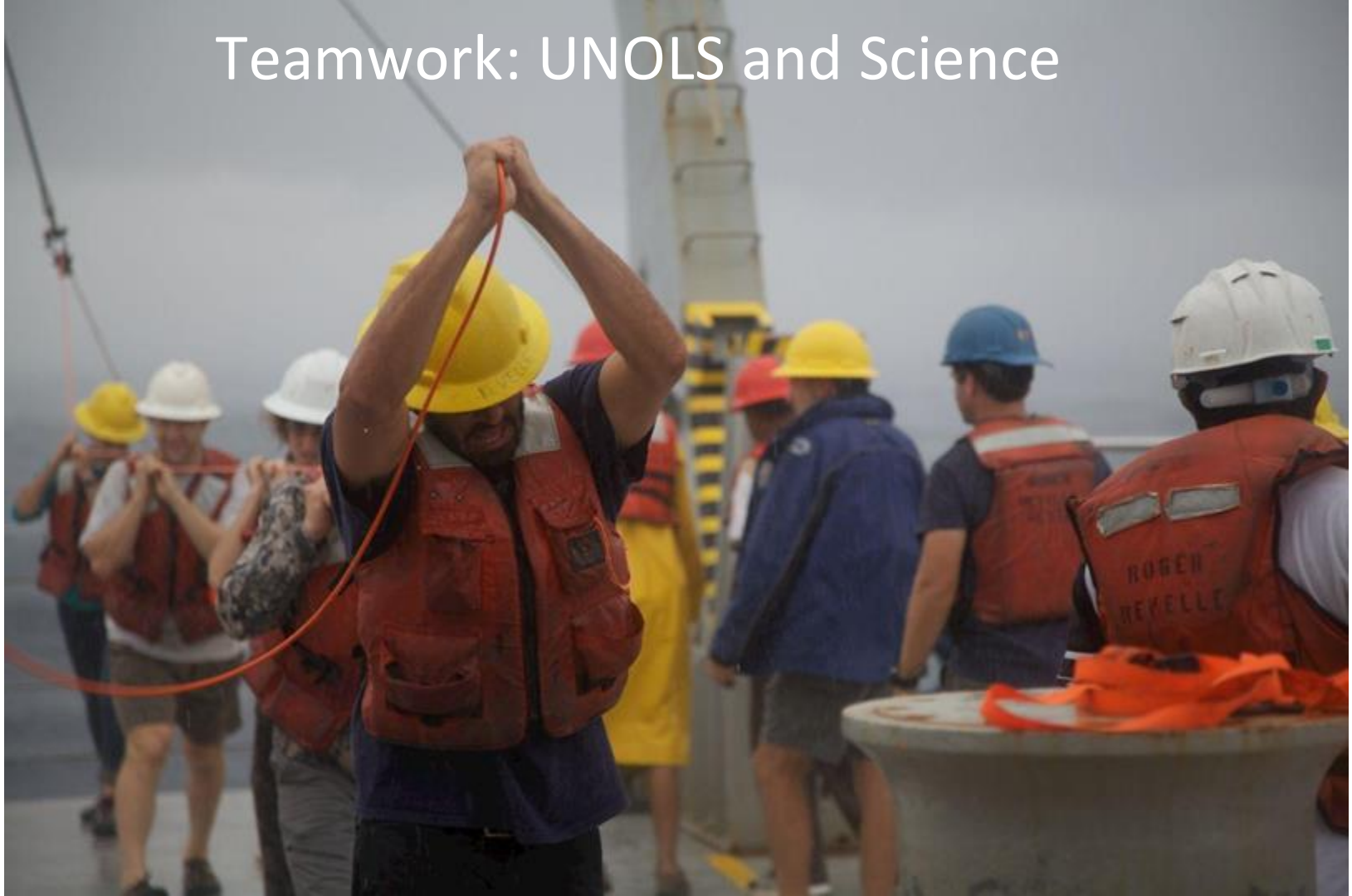
2014: First visit of US Research vessel to Indian port in several decades.

Improving forecasts of the Southwest Monsoon: international collaboration

Teamwork: UNOLS and Science



Hey, sometime things aren’t going to work, and we aren’t going to be on the same page.


Be kind to each other and enjoy how awesome our job is!!


Thank you for making
our research possible!!

BACK UP