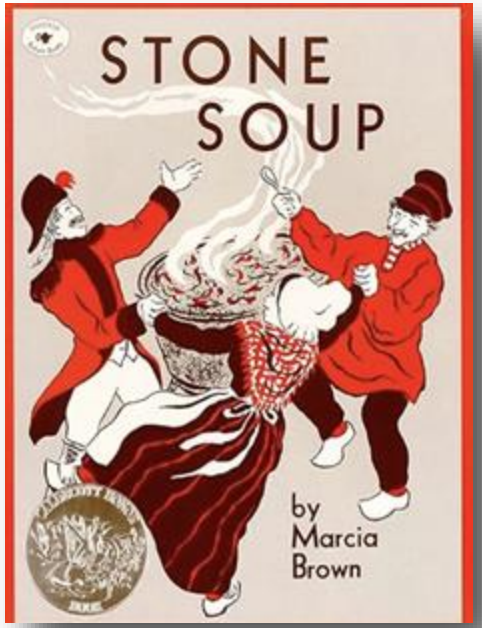


Stone Soup & Christmas Trees

A story of Station Papa

Meghan Cronin (NOAA PMEL) with contributions from the **Ocean Climate Stations group at PMEL** (N. Anderson, P. Berk, K. Kohlman, D. Zhang), the **PMEL Carbon Group** (A. Sutton), **UW APL Wave & Acoustics** (J. Thomson, J. Yang), **PMEL Acoustics** (R. Dziak), **PMEL Engineering** (N. Lawrence-Slavas, S. Stalin), **Canadian DFO Line P Program** (M. Robert), and **OOI Papa global node team** (J. Edson, A. Pleuddemann),

OOI Facility Board & its Data Systems Committee | University of Washington OTB & Virtual | November 14, 2024

Original PIs for Station Papa project in 2007

NOAA PMEL Ocean Climate Station group in 2023

The Mission of OCS (Ocean Climate Stations)

…is to make long time series and high resolution meteorological and oceanic measurements to improve satellite products and forecast models, and to improve our understanding of air-sea interactions and their role within the climate system.

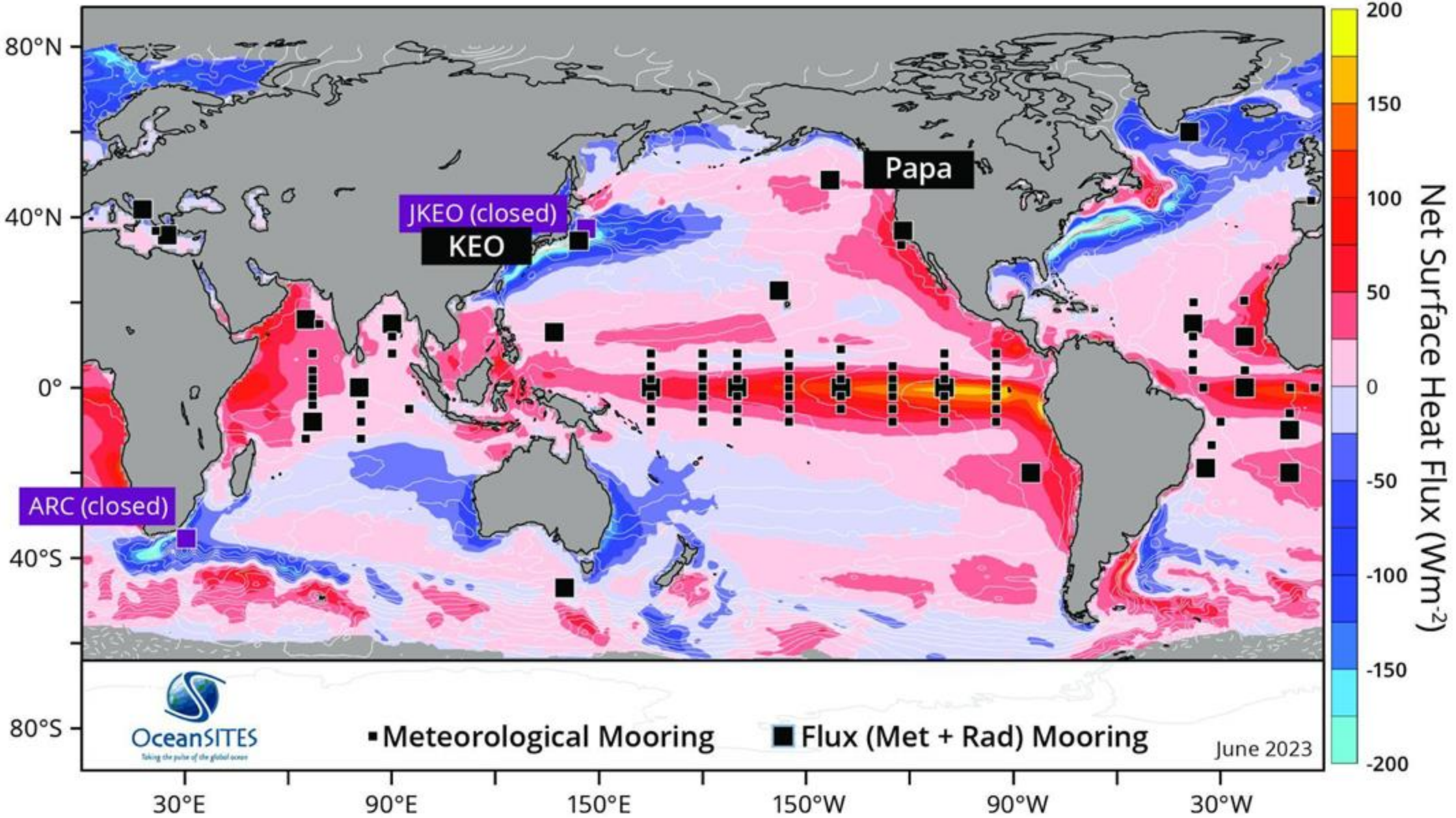
https://www.pmel.noaa.gov/OCS

The Mission of OASIS

(Observing Air-Sea Interactions Strategy)

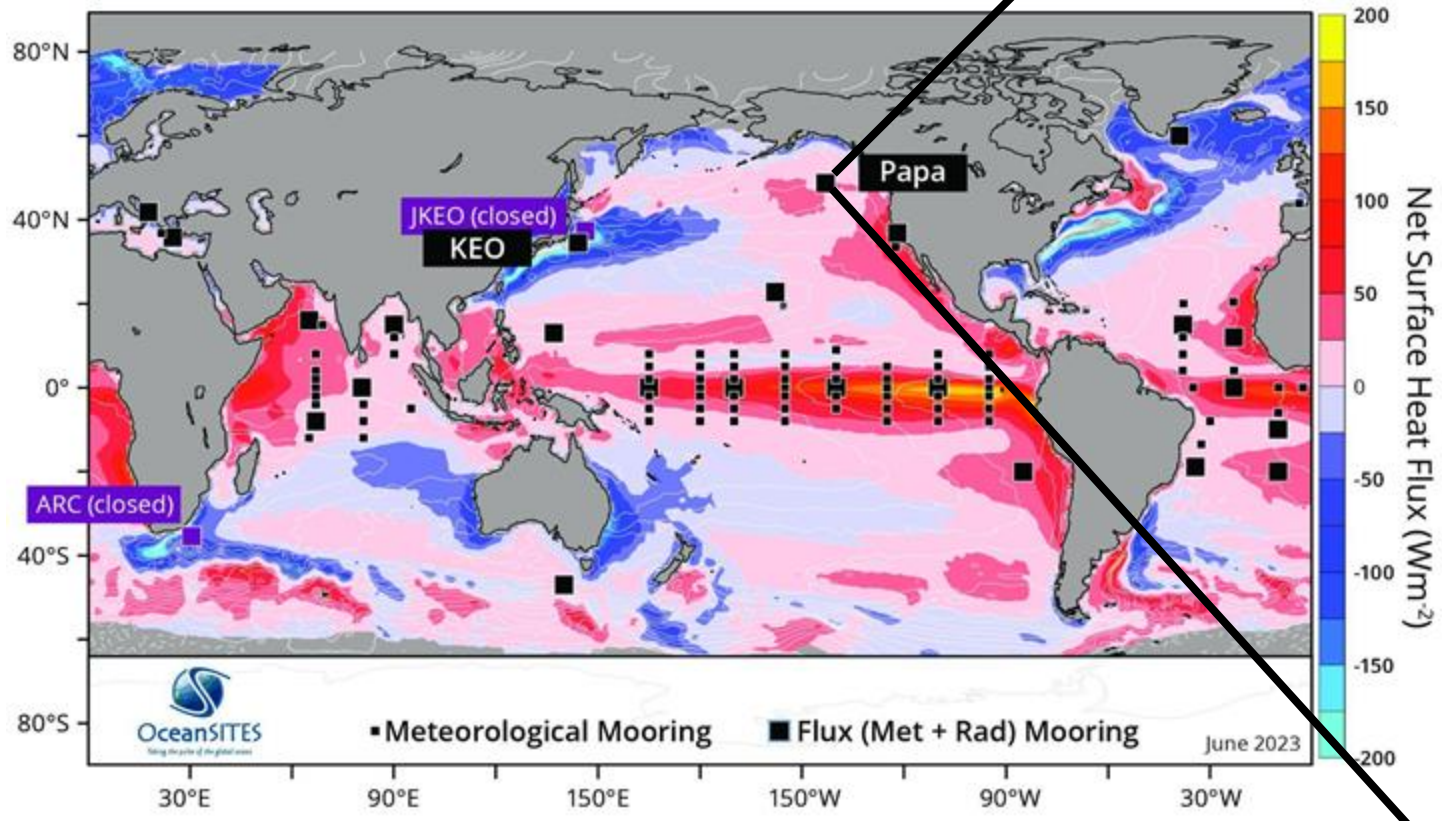
…is to develop a practical, integrated approach to observing air-sea exchanges associated with the Energy, Water, Carbon and Life Cycles

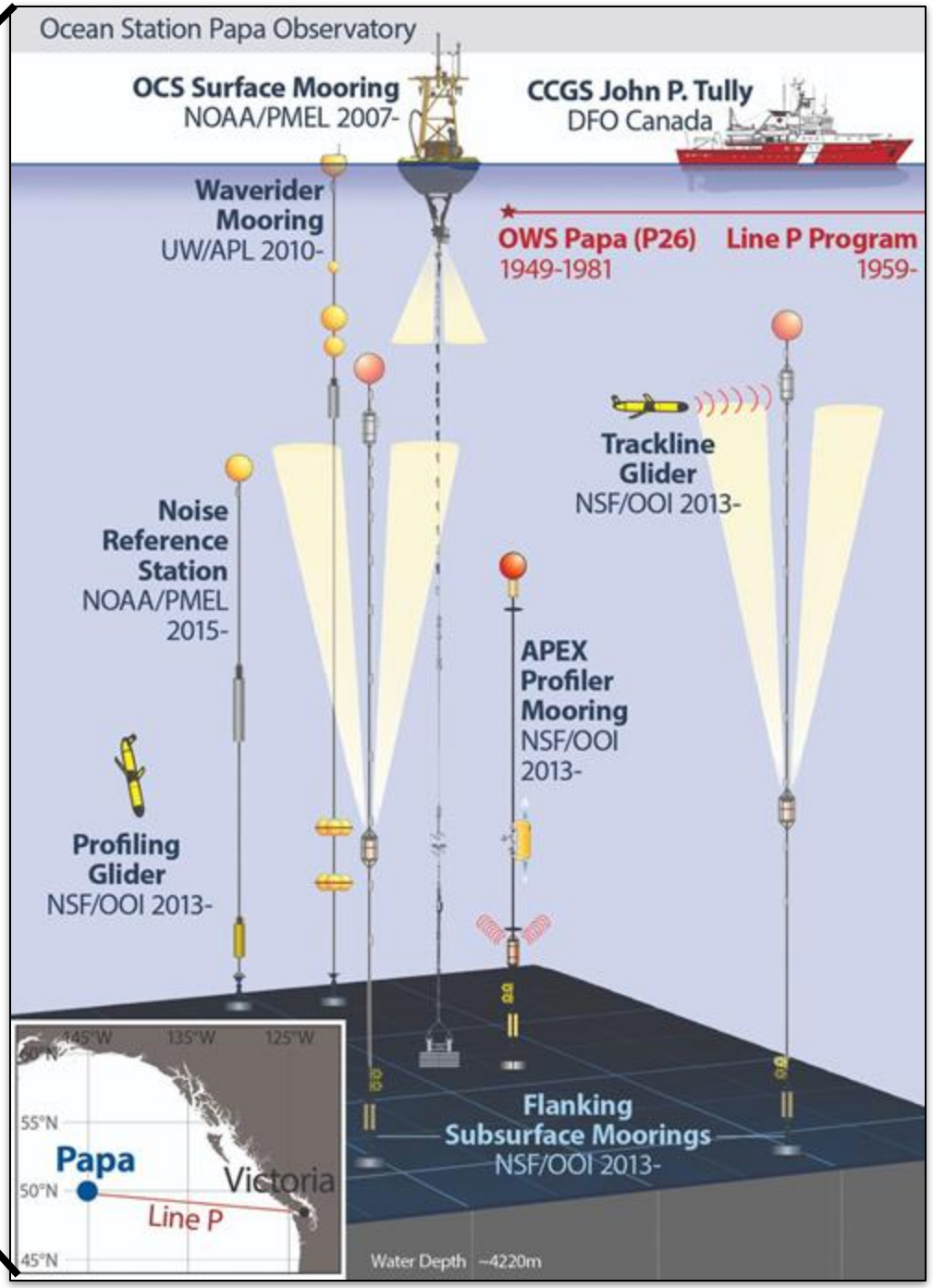
https://airseaobs.org/get-involved



Cronin et al. (2023) Figure 1

Ocean Station Papa Observatory

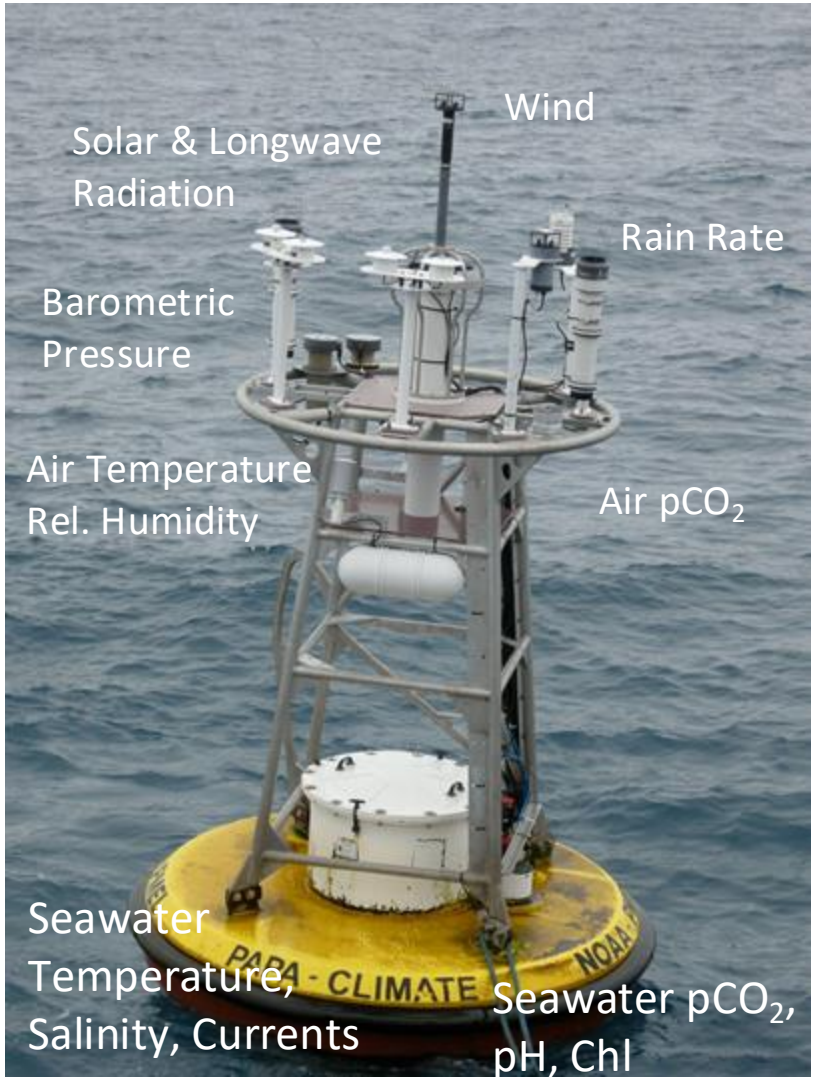




Cronin et al. (2023) Figure 1 & 3

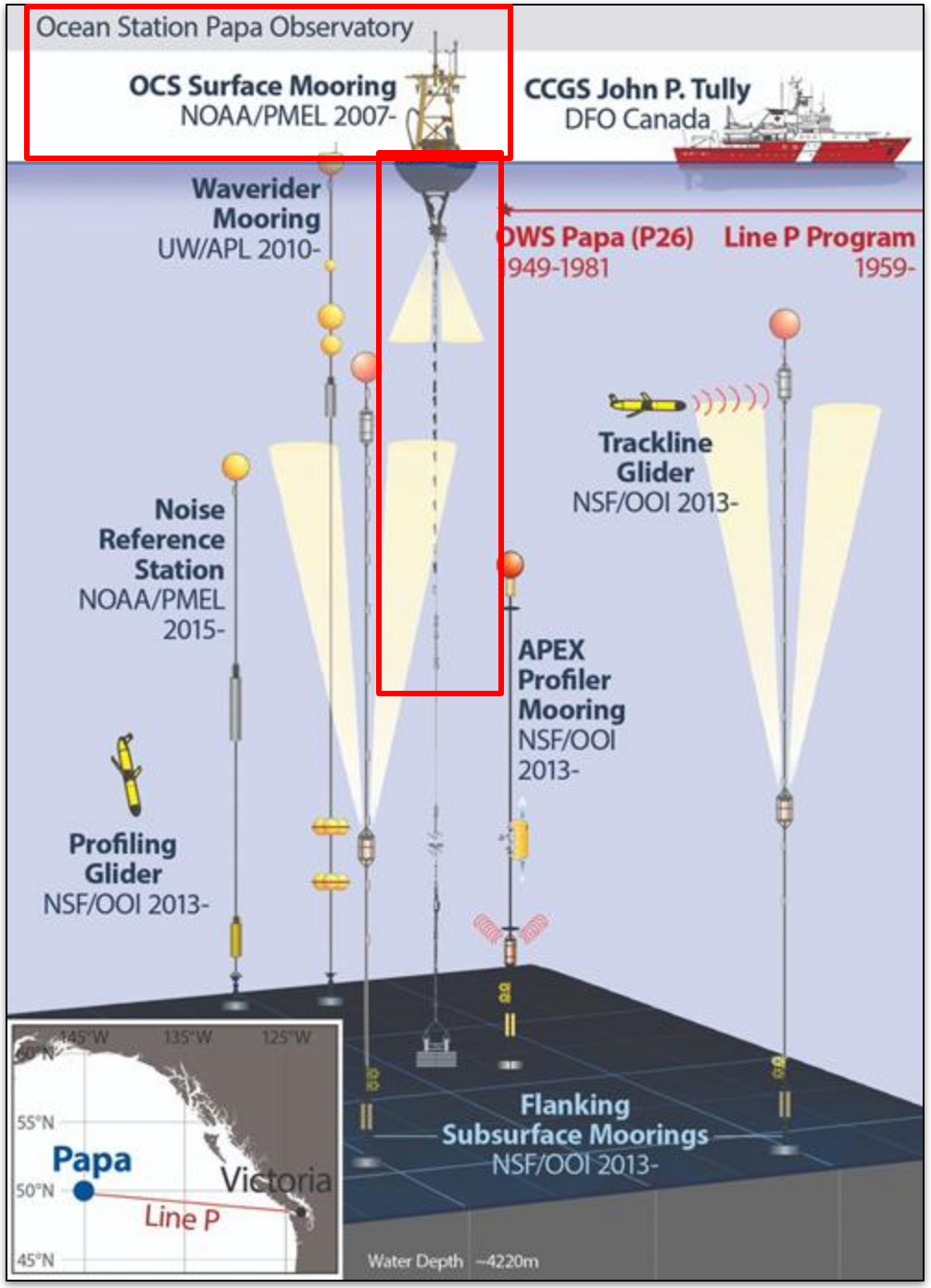
Ocean Station Papa Observatory

NOAA PMEL's Ocean Climate Station (2007-)
with CO_2 system and Ocean Acidification sensor suite



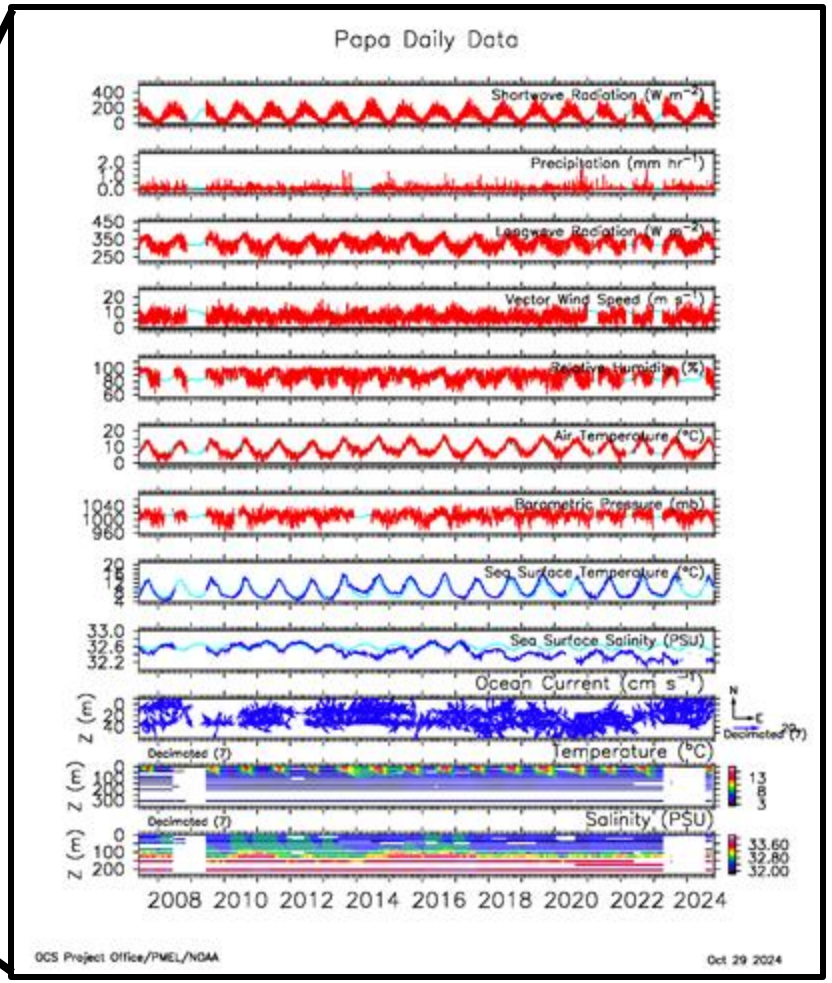
NOAA PMEL's **Ocean Climate Station** group

Adrienne Sutton
(Carbon Group)



OCS Website: www.pmel.noaa.gov/ocs/Papa/

All data are freely available and collaborations with OCS are encouraged.
Please let us know about any publication using this data. We will add it to the bibliography!



~2,300 (est.) Papa mooring data downloads from OCS website in FY24

12 peer-reviewed science papers published since 2023

Ocean Station Papa Observatory

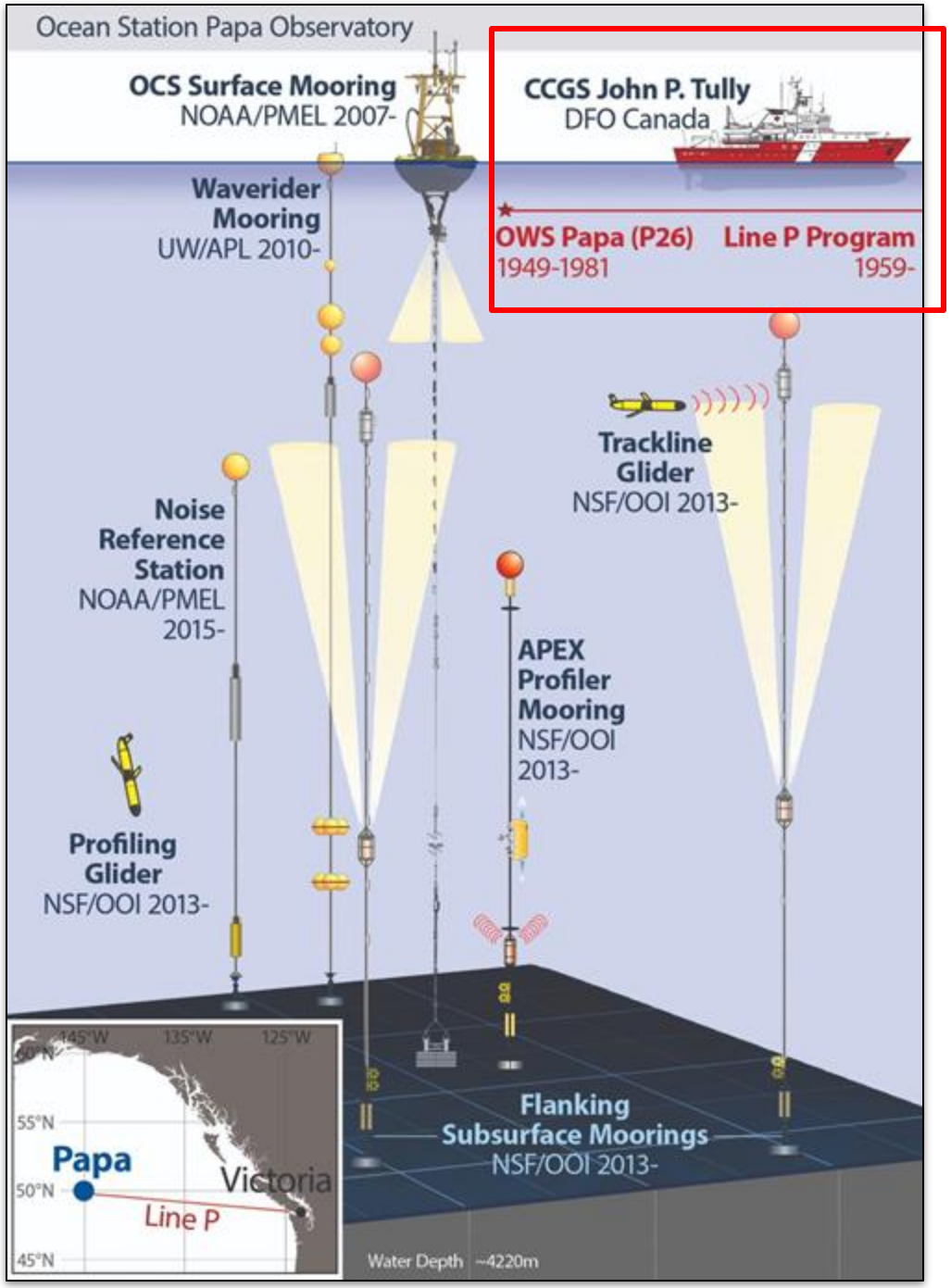
Ocean Weather Station Papa (1949-1981)

Canadian DFO Line P Program (1956-)

Canadian DFO Pacific Oceanographic Group in 1962

Ocean Weather Ship Papa at 50N, 145W (1949-1981)

The *CCGS John P. Tully* in May 2003 embarking on trip to Ocean Station Papa

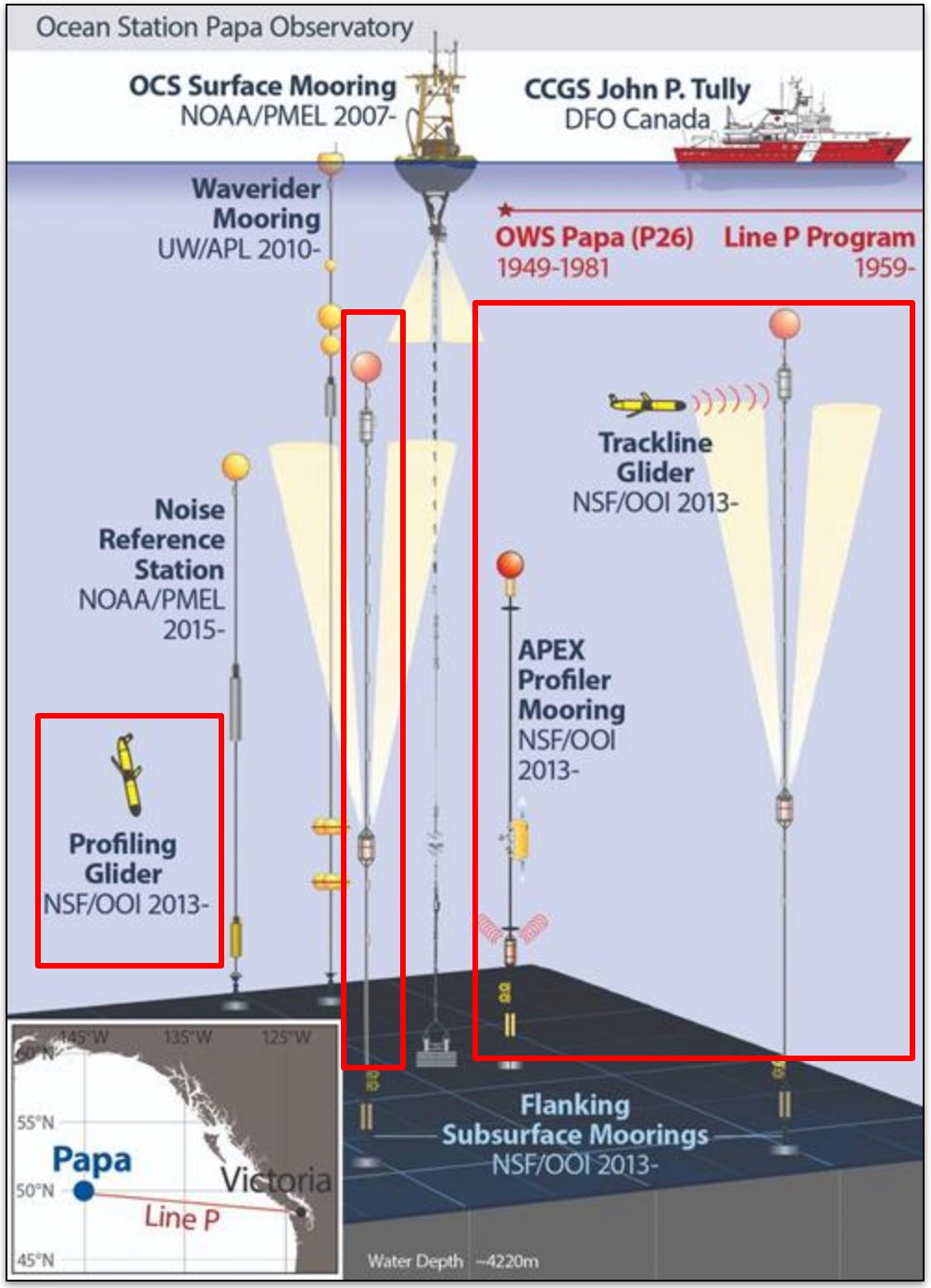


Ocean Station Papa Observatory

NSF Ocean Observatories Initiative (OOI) (2013-)

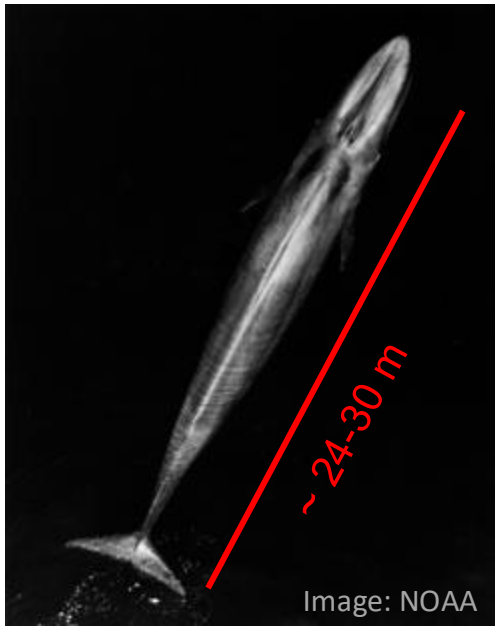
Preparation for Station Papa deployment.
Credit: Paul Chua © WHOI.

R/V Sikuliaq returning to Seward Alaska after successful Station Papa operations.
Credit: Rebecca Travis © WHOI.

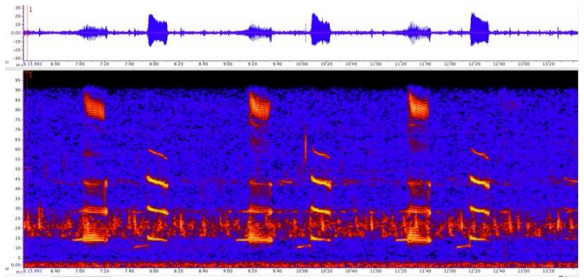


Ocean Station Papa Observatory

NOAA PMEL's Noise Reference Station (2015-)
UW APL Passive Acoustic Listening Device (2007-)



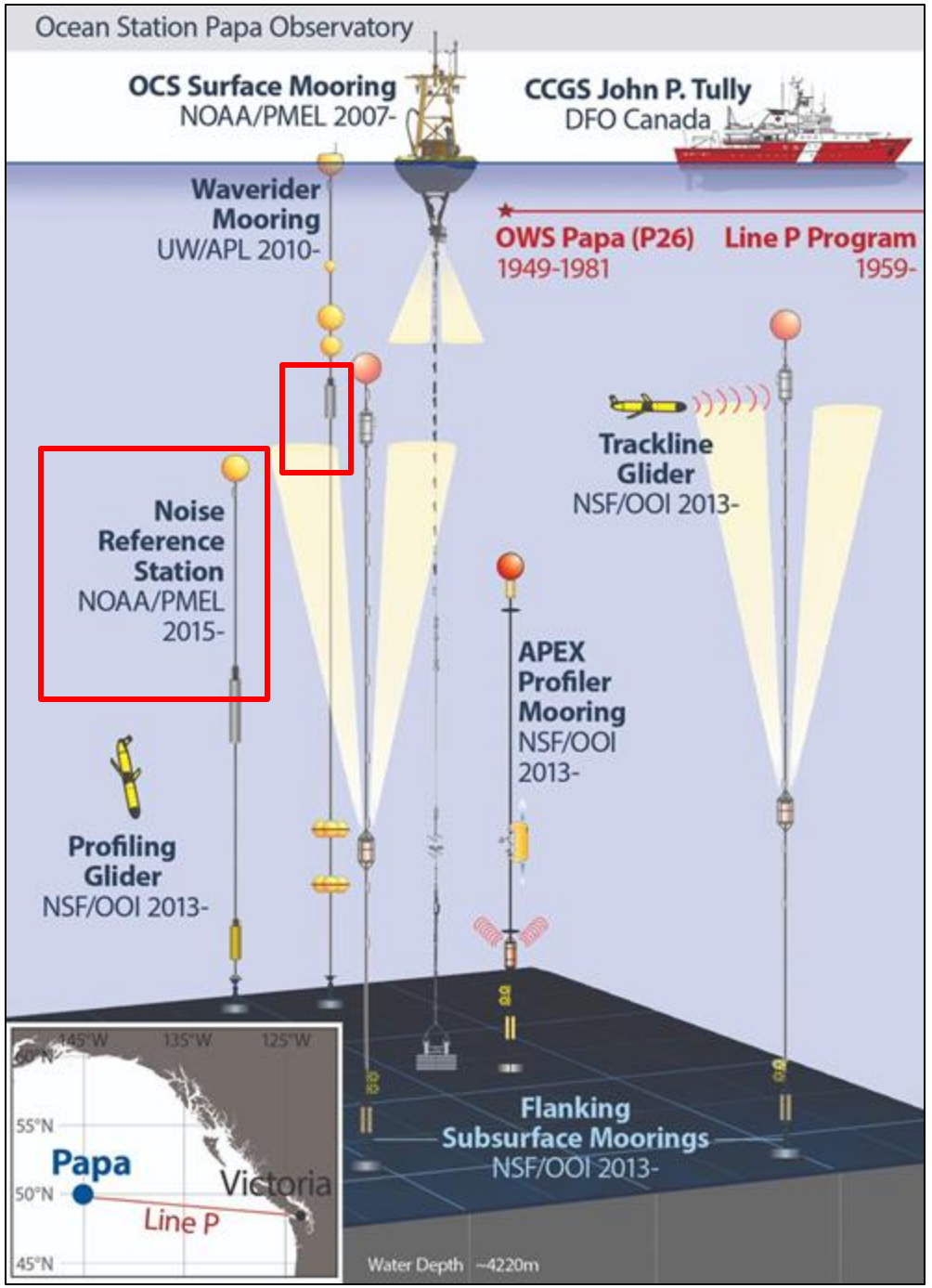
Blue whale are heard every month of the year at Station P, but peak in summer. Image NOAA Fisheries. Sounds file courtesy Bob Dziak.



Bob Dziak (NOAA PMEL Acoustic Group)

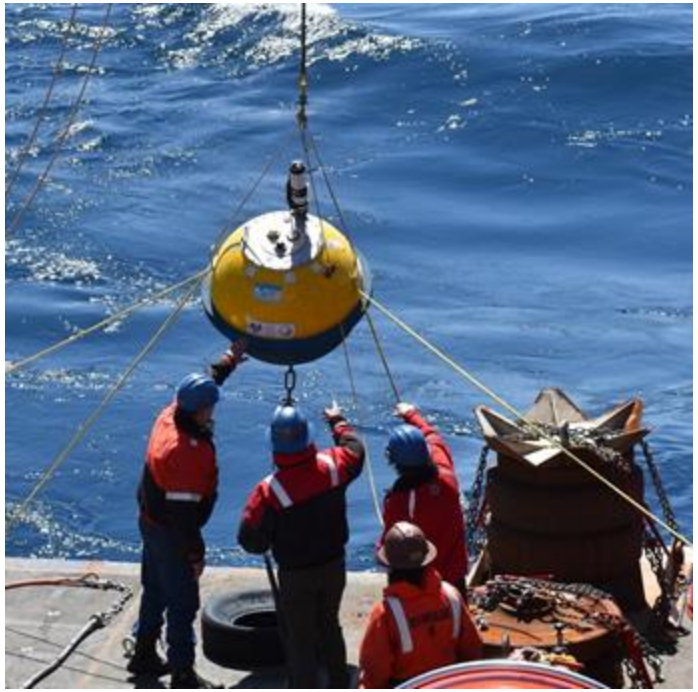
Jie Yang (UW APL)

Environmental sounds are being used to monitor wind, rain and impacts of wave breaking by UW APL.



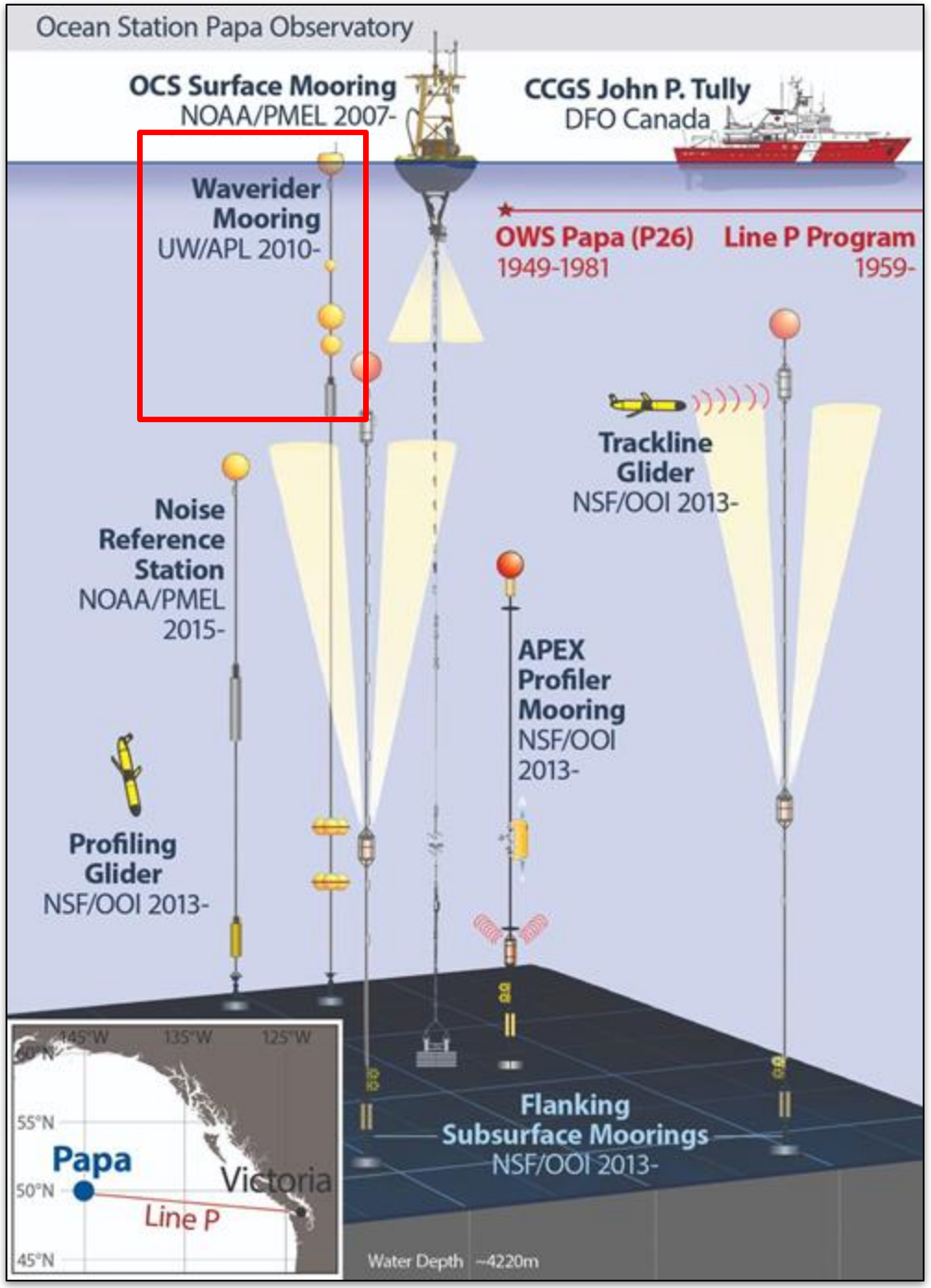
Ocean Station Papa Observatory

UW APL Waverider Mooring (2010-)



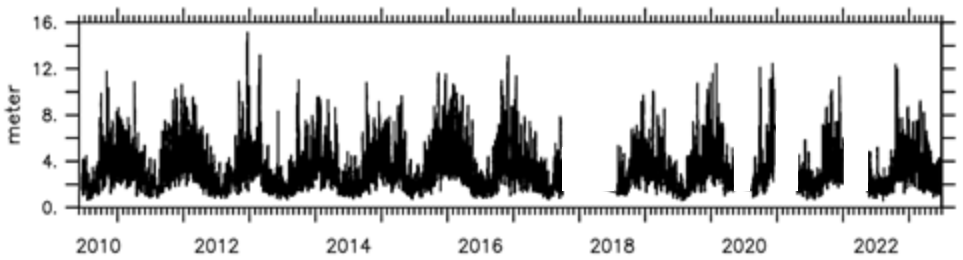
Waverider mooring deployment. Photos UW APL.

Jim Thomson
(UW APL)



Ocean Station Papa Observatory

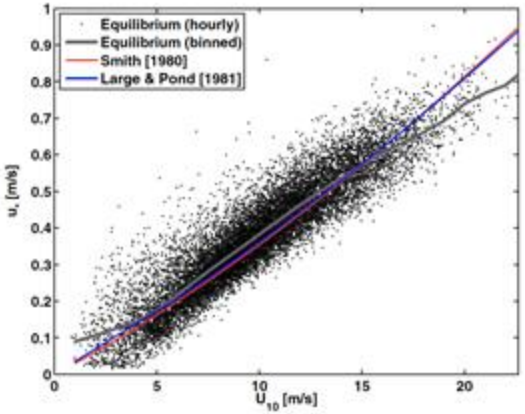
UW APL Waverider Mooring (2010-)



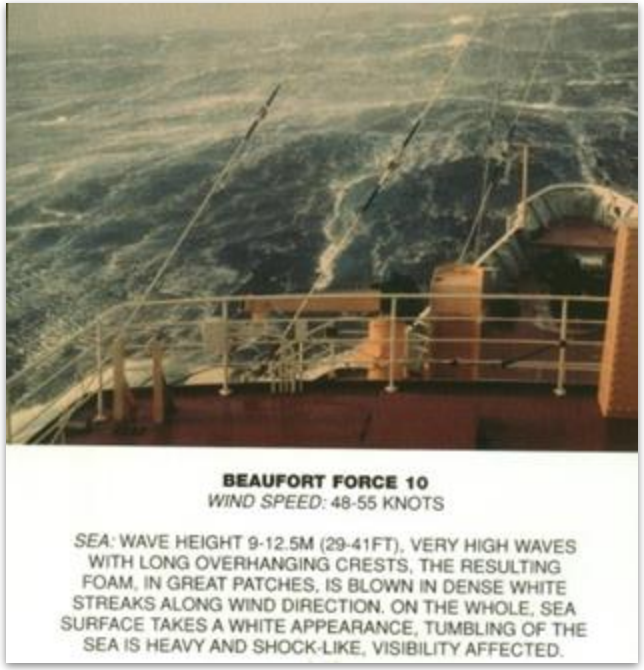
significant wave height

Jim Thomson
(UW APL)

Wind*, est. from Waves



Winds Measured by Buoy



BEAUFORT FORCE 10
WIND SPEED: 48-55 KNOTS

SEA: WAVE HEIGHT 9-12.5M (29-41FT). VERY HIGH WAVES WITH LONG OVERHANGING CRESTS. THE RESULTING FOAM, IN GREAT PATCHES, IS BLOWN IN DENSE WHITE STREAKS ALONG WIND DIRECTION. ON THE WHOLE, SEA SURFACE TAKES A WHITE APPEARANCE. TUMBLING OF THE SEA IS HEAVY AND SHOCK-LIKE. VISIBILITY AFFECTED.

An old idea backed by modern data

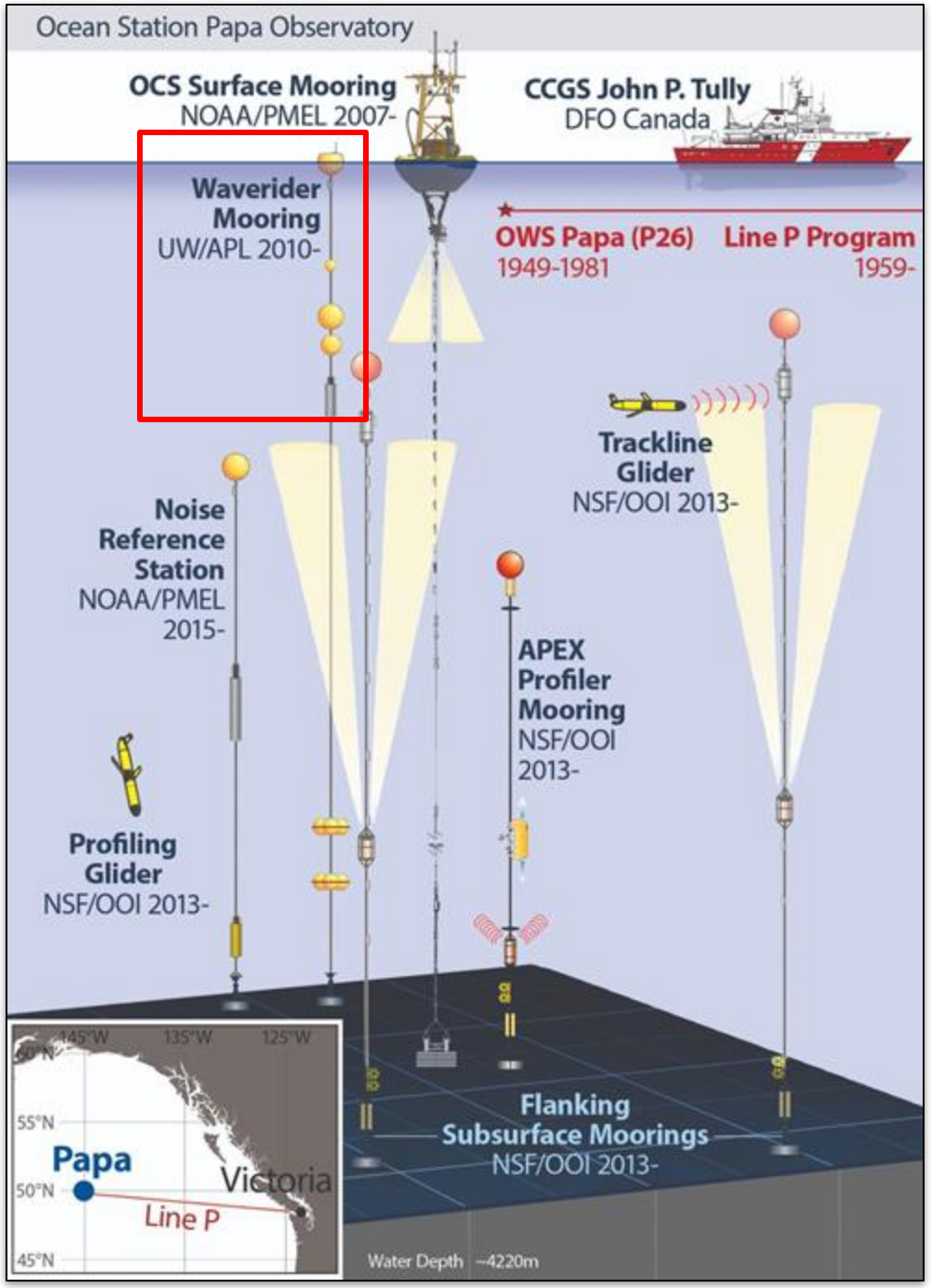
JGR Oceans **Published in 2013**

Regular Article | Free Access

Waves and the equilibrium range at Ocean Weather Station P

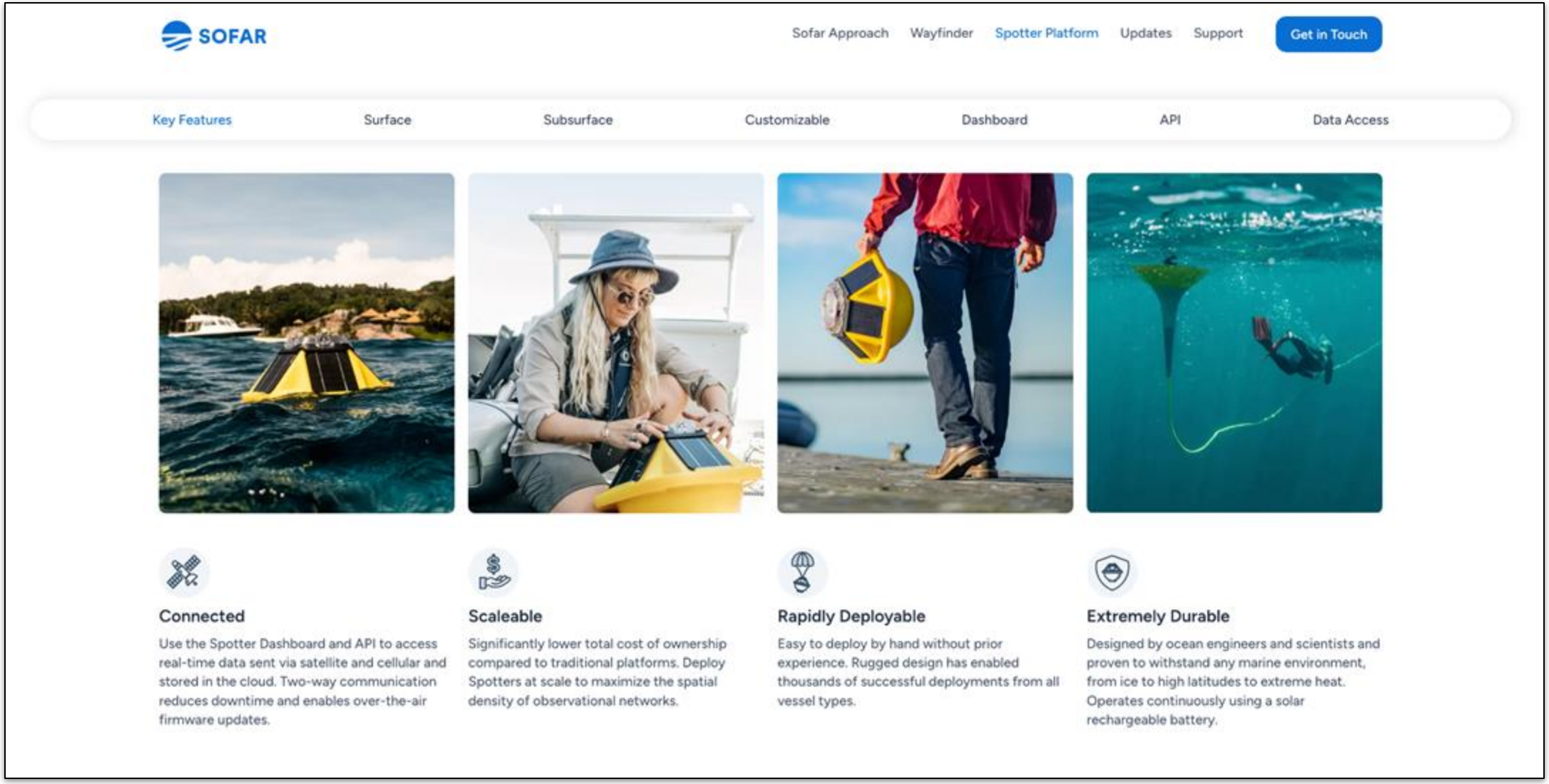
J. Thomson, E. A. D'Asaro, M. F. Cronin, W. E. Rogers, R. R. Harcourt, A. Shcherbina

First published: 08 October 2013 | https://doi.org/10.1002/2013JC008837 | Citations: 55



Papa research provides scientific grounding for SOFAR Ocean Technology, Inc. founded in 2016 by Tim Janssen

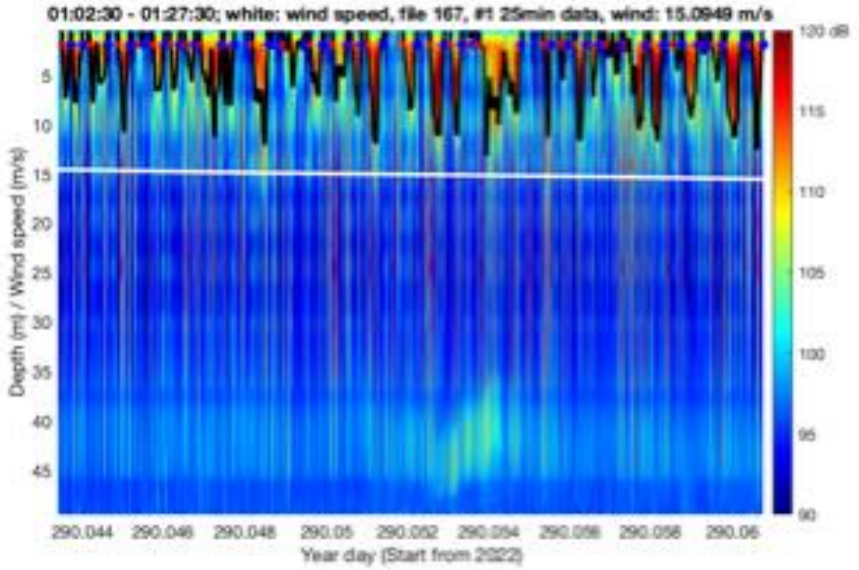
Tim Janssen, PhD (SOFAR)

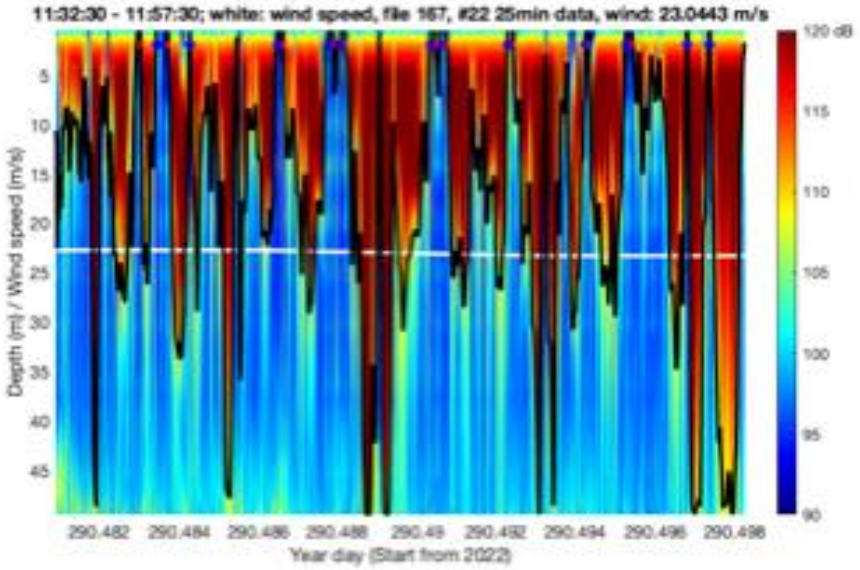


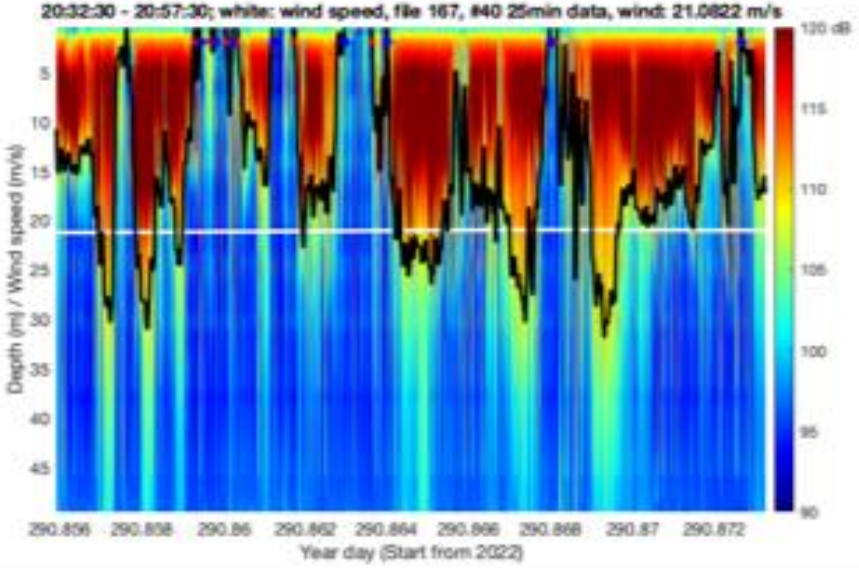
High wind event Oct. 18, 2022

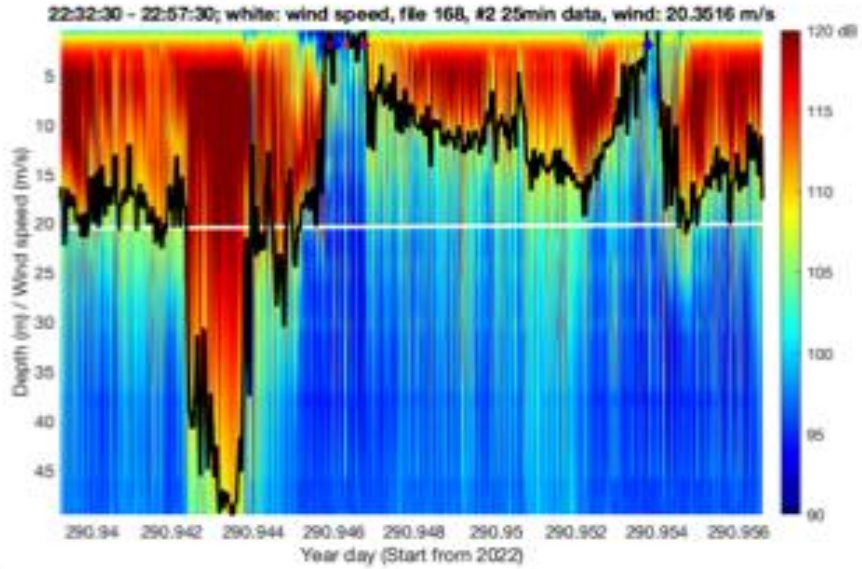
Identifying bubble plume structure using a fixed backscatter strength level

Each frame: 25-min Signature 500 echo data; white curve: wind speed (m/s)



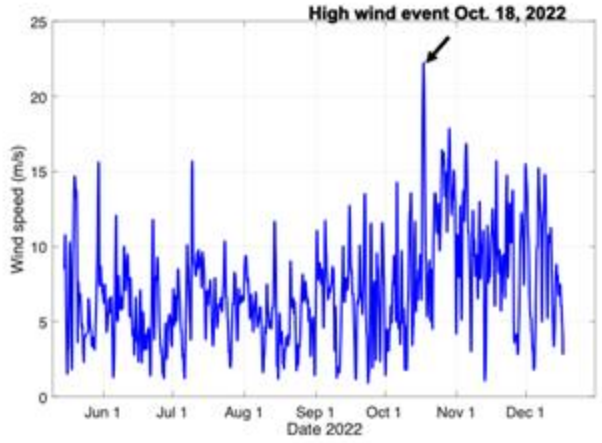






ADCP with echo sounder Nortek Signature 500

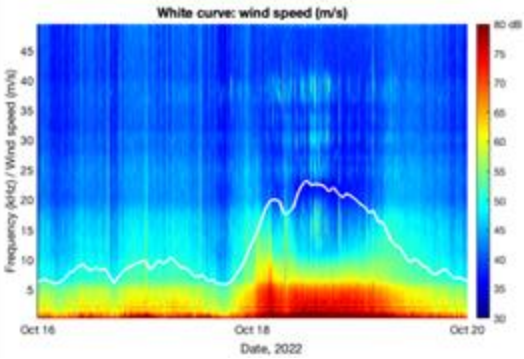
Jie Yang (UW APL)



High wind event Oct. 18, 2022

Ambient noise vs wind speed

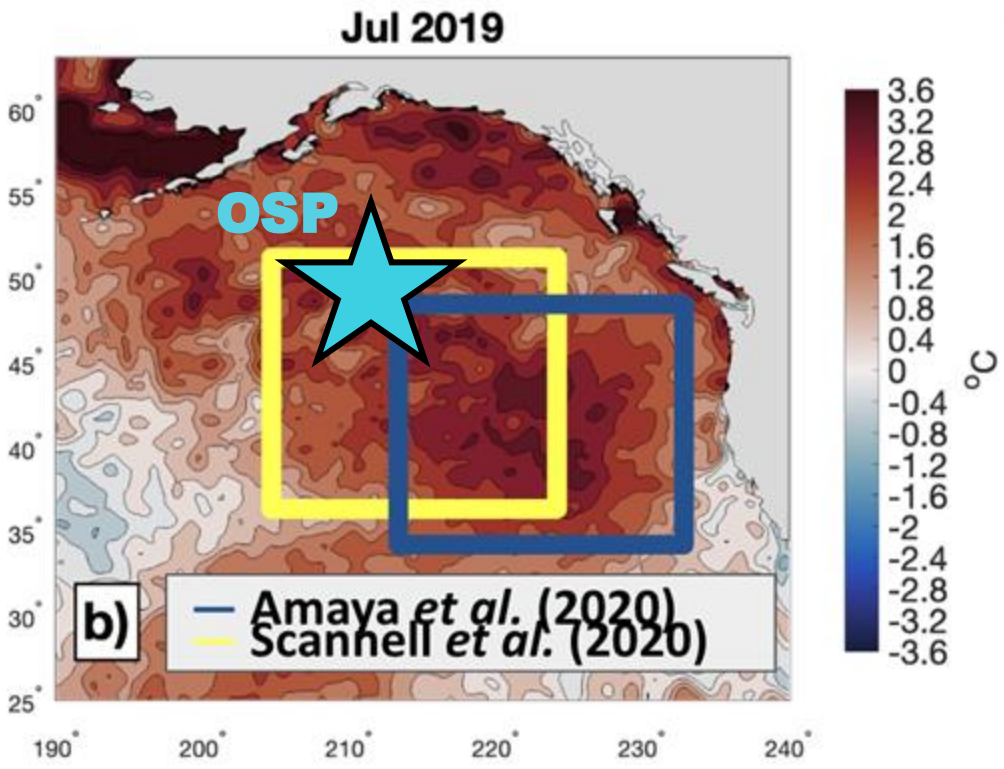
Background color: ambient noise spectrogram recorded by PAL

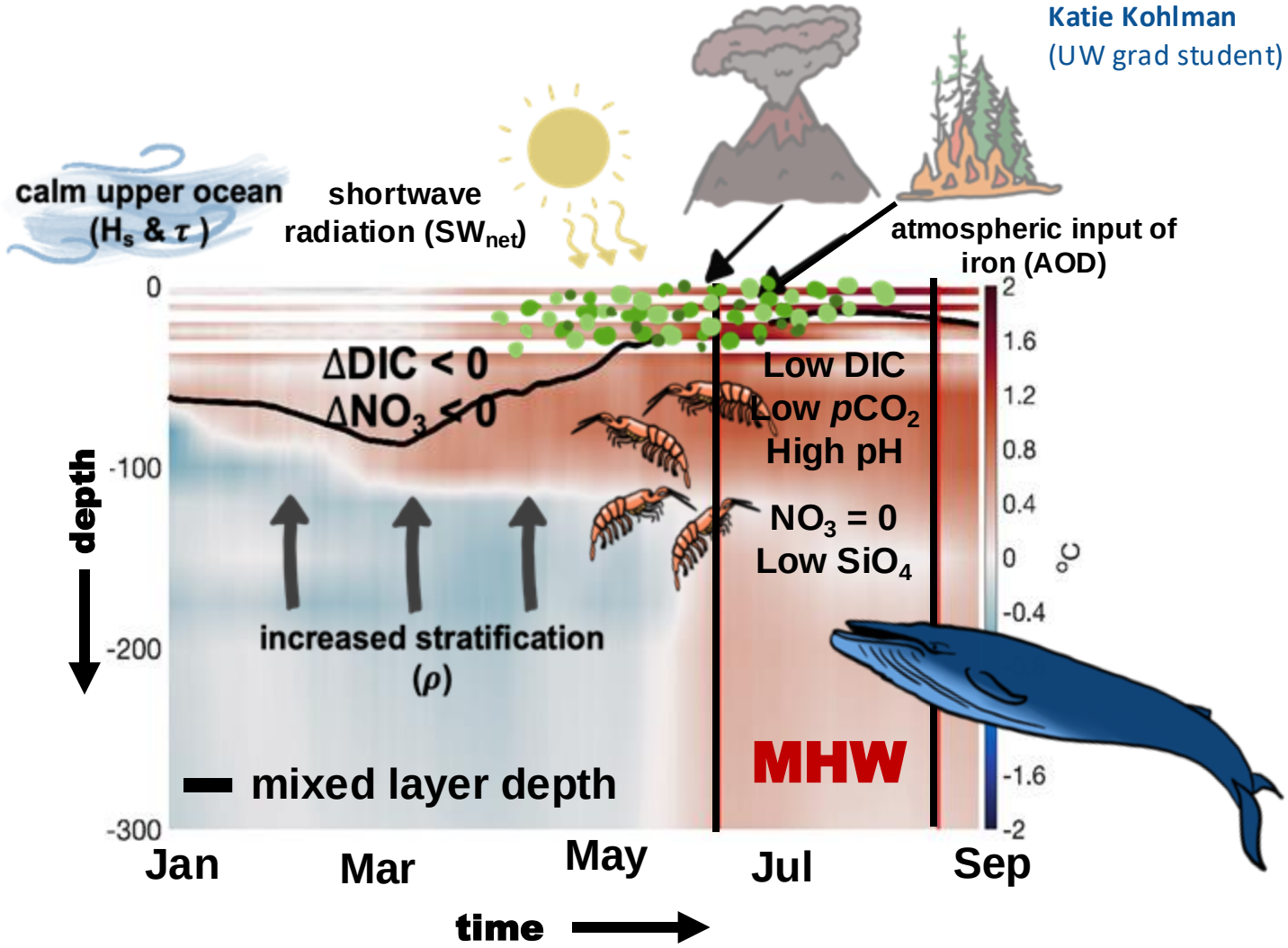


Kohlman et al. (2024): The 2019 marine heatwave at Ocean Station Papa: A multi-disciplinary assessment of ocean conditions and impacts on marine ecosystems

Katie Kohlman
(UW grad student)

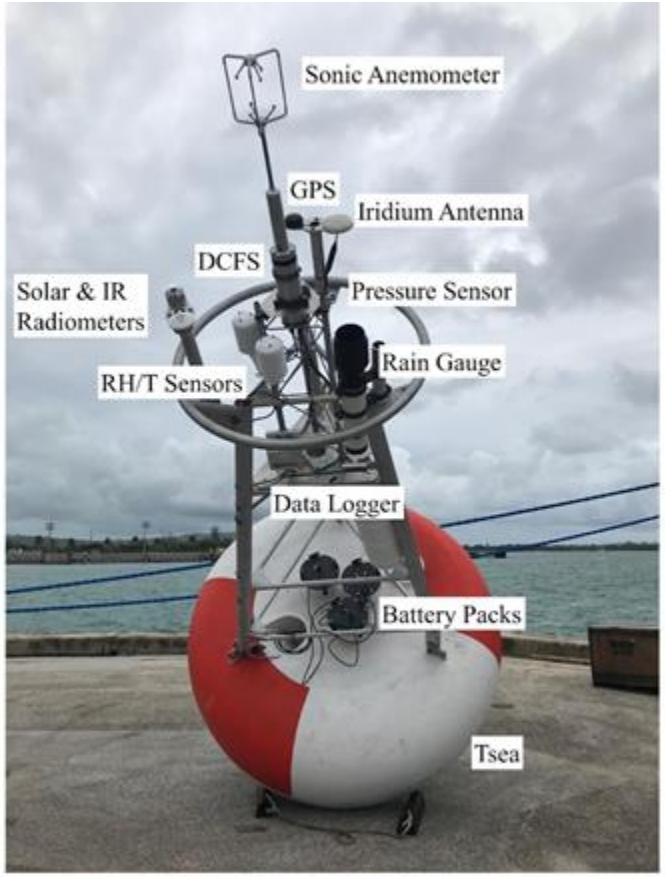
2019 MHW or 'Blob2.0'





WHOI Direct Covariance Flux System (**DCFS**) Enhancement for PMEL mooring

would use similar configuration to what was done during the 2019 Pilot Study



Sensor locations for NDBC TAO buoy in 2019

Pilot Study Deployment

- Date: October 4, 2019
- Location: 0°, 165°E

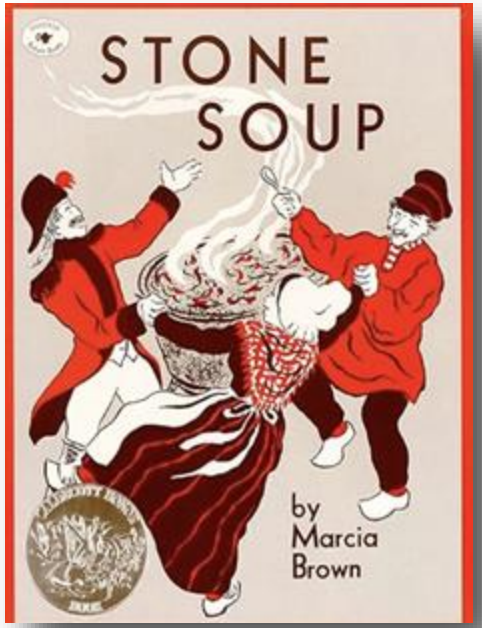
Instrumentation

- 3-axis Sonic Anemometer
- 3-axis Motion Package
- Solar and IR Radiometers
- Redundant RH/T_{air} Sensors
- Barometer
- Rain Gauge
- T_{sea} and Salinity Sensor
- GPS (time) and Iridium

Real-time Delivery of

- Direct Covariance Surface Stress and Buoyancy Fluxes
- Radiative Fluxes
- Bulk Momentum, Sensible and Latent Heat Fluxes
- Net Heat Flux
- Waves

On the NOAA OCS Papa mooring, the WHOI DCFS would be placed on ring as a secondary wind system



Stone Soup & Christmas Trees – A story of Station Papa

- NOAA mooring turnarounds on the OOI cruise in 2025?
- OOI direct covariance flux system on the NOAA surface mooring?
- OOI data should be accessible through OceanSITES

About OASIS

Observing Air-Sea Interactions Strategy (OASIS) is harmonizing community recommendations from OceanObs'19 and UN Decade Laboratories into **three Grand Ideas + one Grandest Idea of All**

OASIS Mission is to develop a **practical, integrated approach for observing air-sea exchanges** associated with the Energy, Water, Carbon and **Life Cycles**

OASIS envisions a pathway to Get Involved in Ocean-Atmosphere Interaction Science for Sustainable Development.

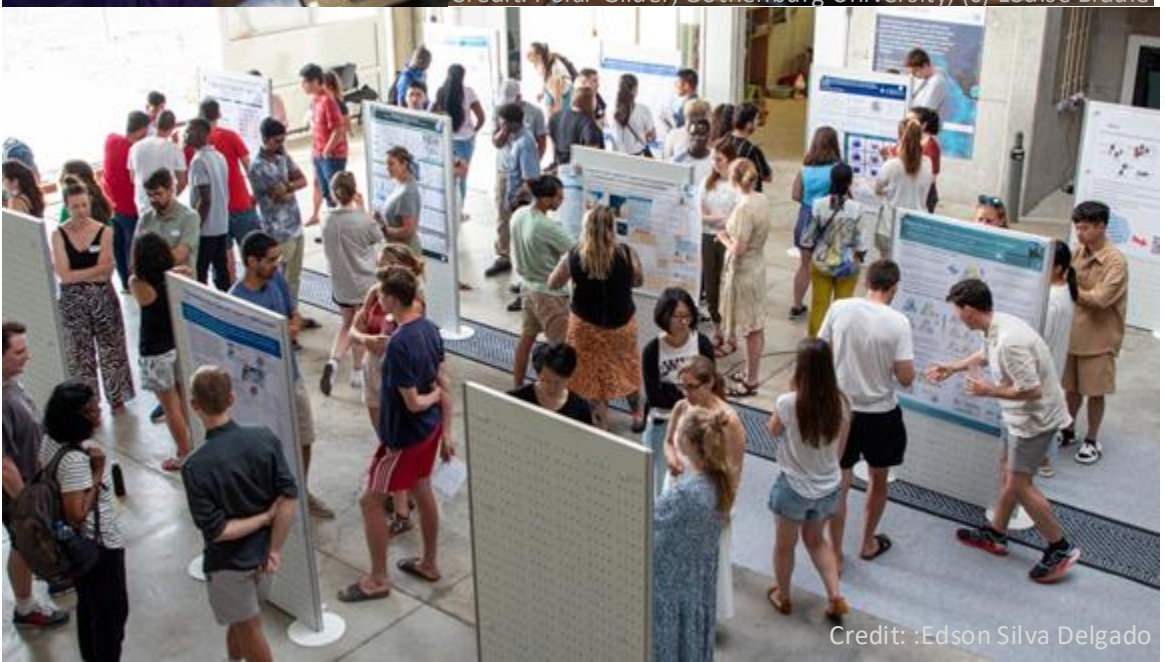
www.airseaobs.org/get-involved

OASIS Co-Chairs:
Meghan Cronin (NOAA PMEL, USA), Christa Marandino (GEOMAR, Germany) & Sebastiaan Swart (University of Gothenburg, Sweden)
SCOR Working Group #162 & OASIS community

From Cronin et al. (2023)

OASIS Theory of Change

Credit: Polar Glider, Gothenburg University, (c) Louise Biddle

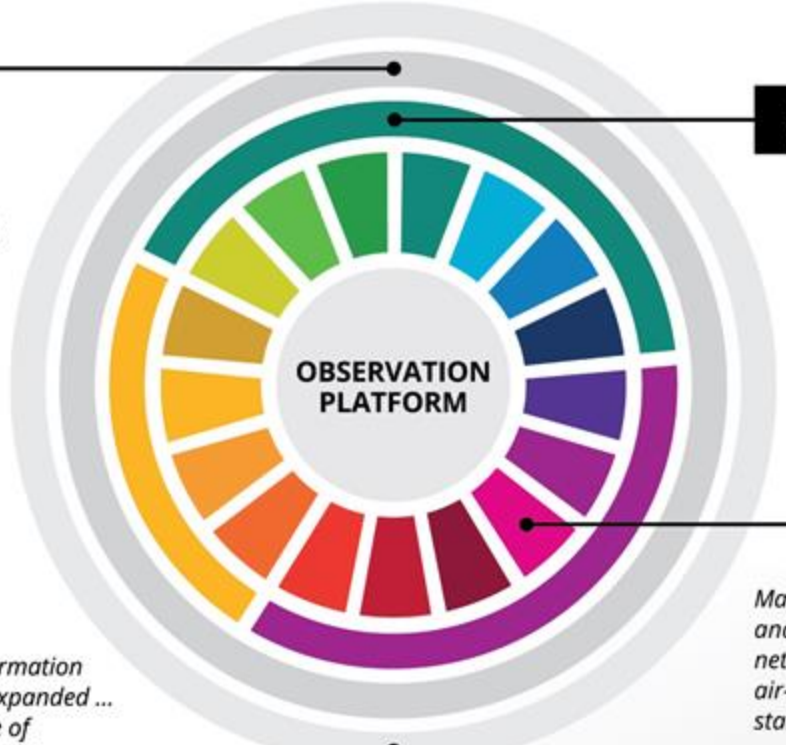


Credit: :Edson Silva Delgado

PARTNERS

- MARINER
- STUDENT
- BEST PRACTICE EXPERT
- DATA SPECIALIST
- ENGINEER
- PRODUCT DEVELOPER
- ANALYST
- PRINCIPAL INVESTIGATOR
- INSTITUTION

Air-sea interaction information could be significantly expanded ... by developing a culture of mentorship and partnership



DERIVED VARIABLES

HIGH RESOLUTION SURFACE ESSENTIAL OCEAN VARIABLES (EOV)

Considered both derived and measured

ESSENTIAL CLIMATE VARIABLES (ECV)

ESSENTIAL BIODIVERSITY VARIABLES (EBV)

MEASURED VARIABLES

Making platforms multidisciplinary and multifunctional, the OASIS network can provide high-quality air-sea fluxes that serve multiple stakeholders.

SCALE

- GLOBAL
- REGIONAL
- LOCAL

EXAMPLE

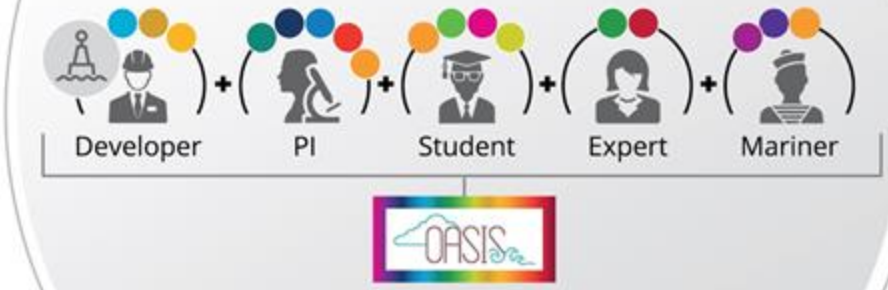


Image: Sarah Battle/NOAA

ECOP-led OASIS Activities

To Join Task Teams: airseaobs.org/get-involved

Grand Idea #1: Expanding the in situ observing system – Fill Gaps in GOOS!

Areas where OOI could contribute

- ☑ Uncrewed Surface Vehicle Network for the Global Ocean Observing System Project
  - ☑ ECOP-led Community of Practice paper, Webinar Series!
  - ☐ Implementing the USV network for GOOS

Grand Idea #2: Improve air-sea interaction observing from satellites

- ☑ Webinar Series! Satellite proposals, next Decadal Survey?

Grand Idea #3: Improve hierarchy of Earth System Models for air-sea interactions

- ☑ Building international partnerships to expand process study field campaigns

OASIS Theory of Change

- ☑ ECOP-organized Best Practices Workshops, ECOP-led Commentary, Community papers
- ☐ Interoperability Experiments
- (☑) Partnership & Capacity Strengthening (summer schools, SIDS AGU sessions)
- ☑ FAIR Data & OASIS Products

Webinar Series: airseaobs.org/resources/webinars OASIS-youtube-channel (125 videos!)