Observing the Air-Sea Interface

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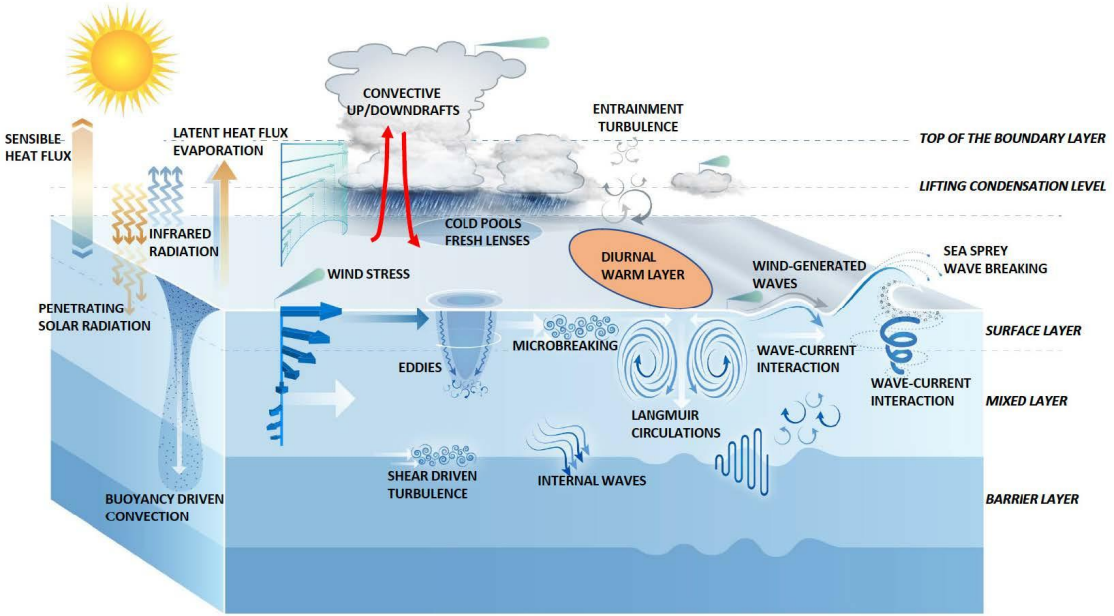
Where & Why

we observe the air-sea interface

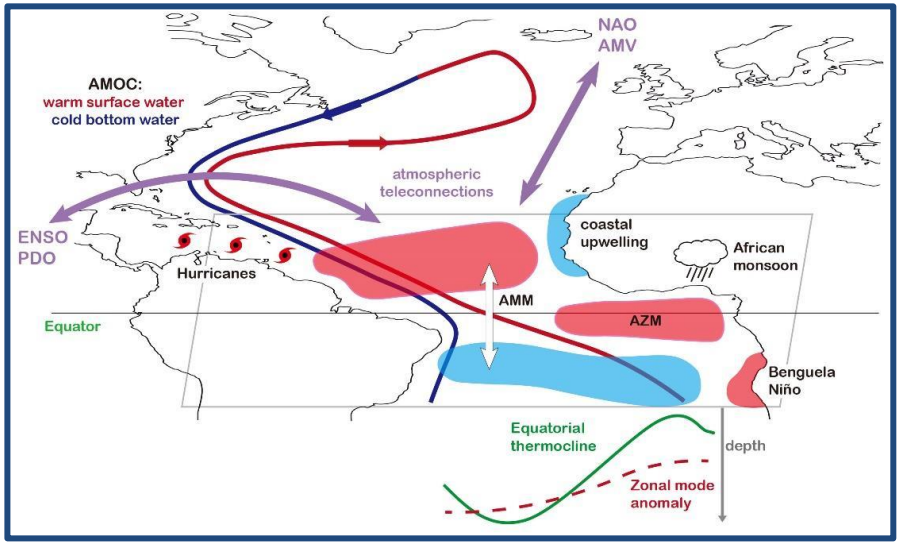
To better model and predict weather hazards, we need improved observations and understanding of processes in the **ocean mixed layer, atmospheric boundary layer**, and **interface** between them.



Where & Why

we observe the air-sea interface

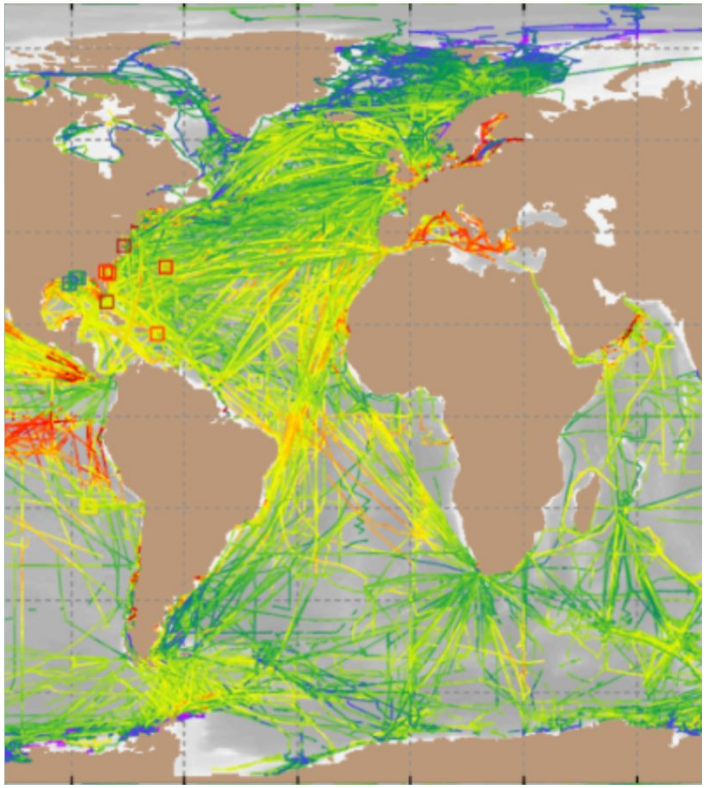
To provide advance warning of shifts in ocean and atmosphere patterns linked to **droughts**, **floods**, **severe storms**, **heat waves**, and **other hazards.**



Where & Why

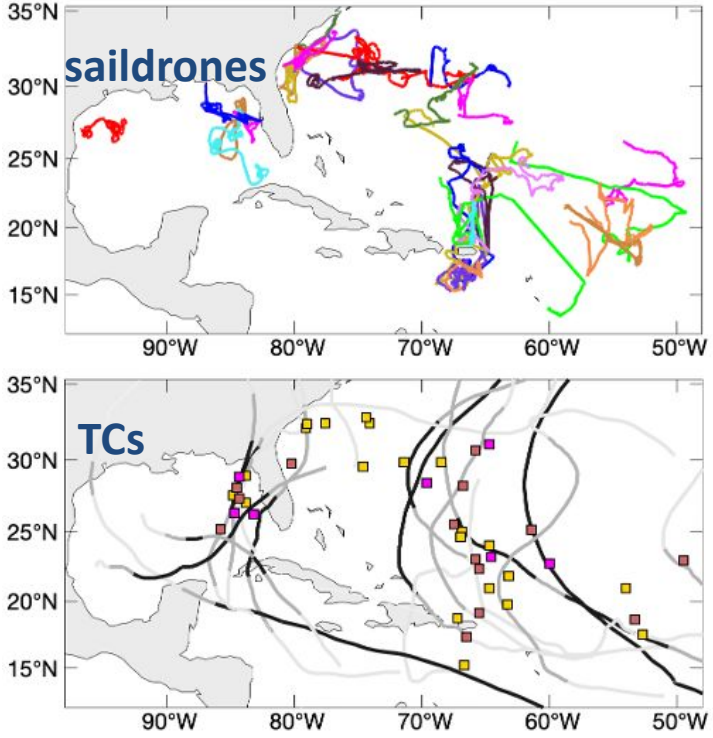
we observe the air-sea interface

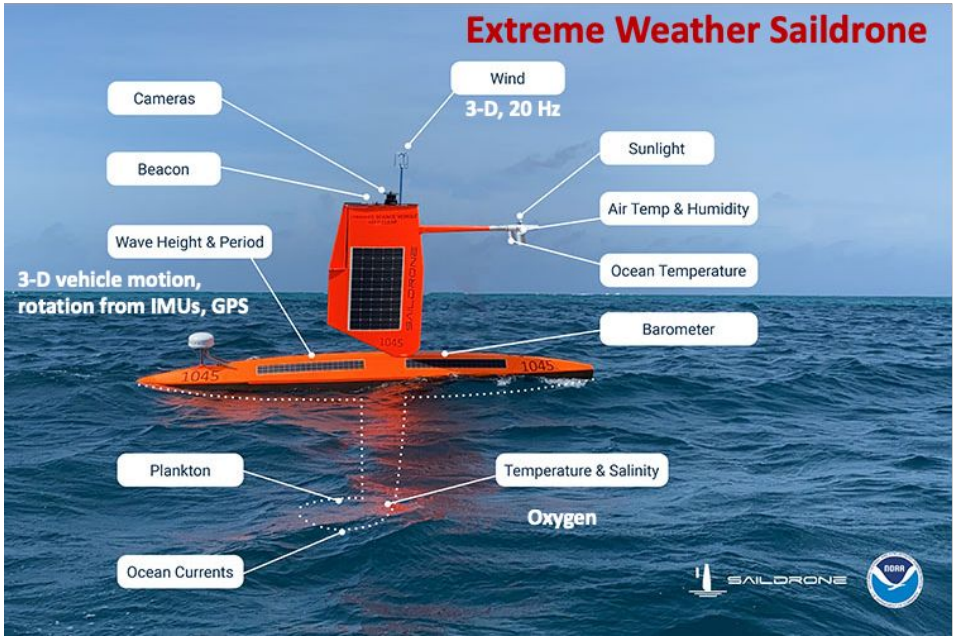
Observations of surface ocean carbon concentrations provide information of the changes in **ocean carbon uptake** and **ocean acidification**, as well as provide invaluable data used to **evaluate ocean biogeochemical models.**



Saildrone Hurricane Observations

2021-2024 saildrone and TC tracks





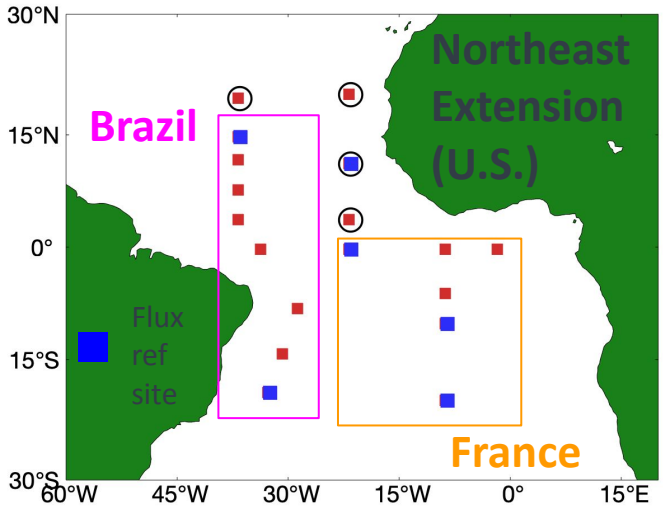
Sustained wind measured

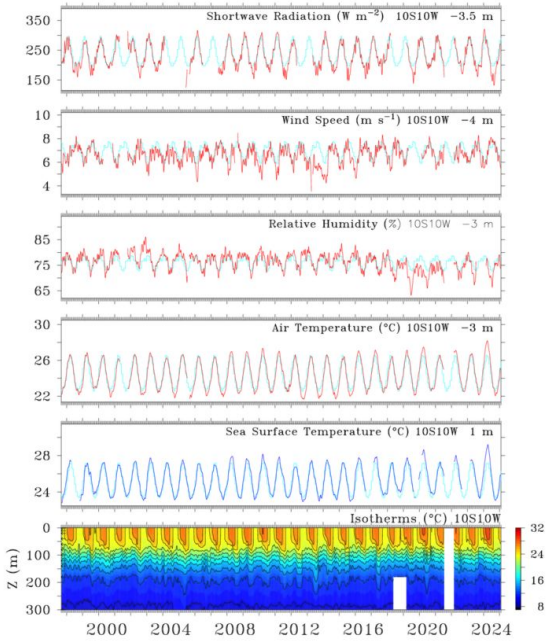
- 34 – 49 kt
- 50 – 63 kt
- 64+ kt

Partnership with NOAA/PMEL and Saildrone, Inc.

Transition plans with NHC, EMC

PIRATA





Cornerstone Array

Established to improve understanding and prediction of tropical Atlantic variability.

Northeast Extension (est. 2005)

NOAA-funded project to study ocean-atmosphere variability in tropical North Atlantic ocean

How?

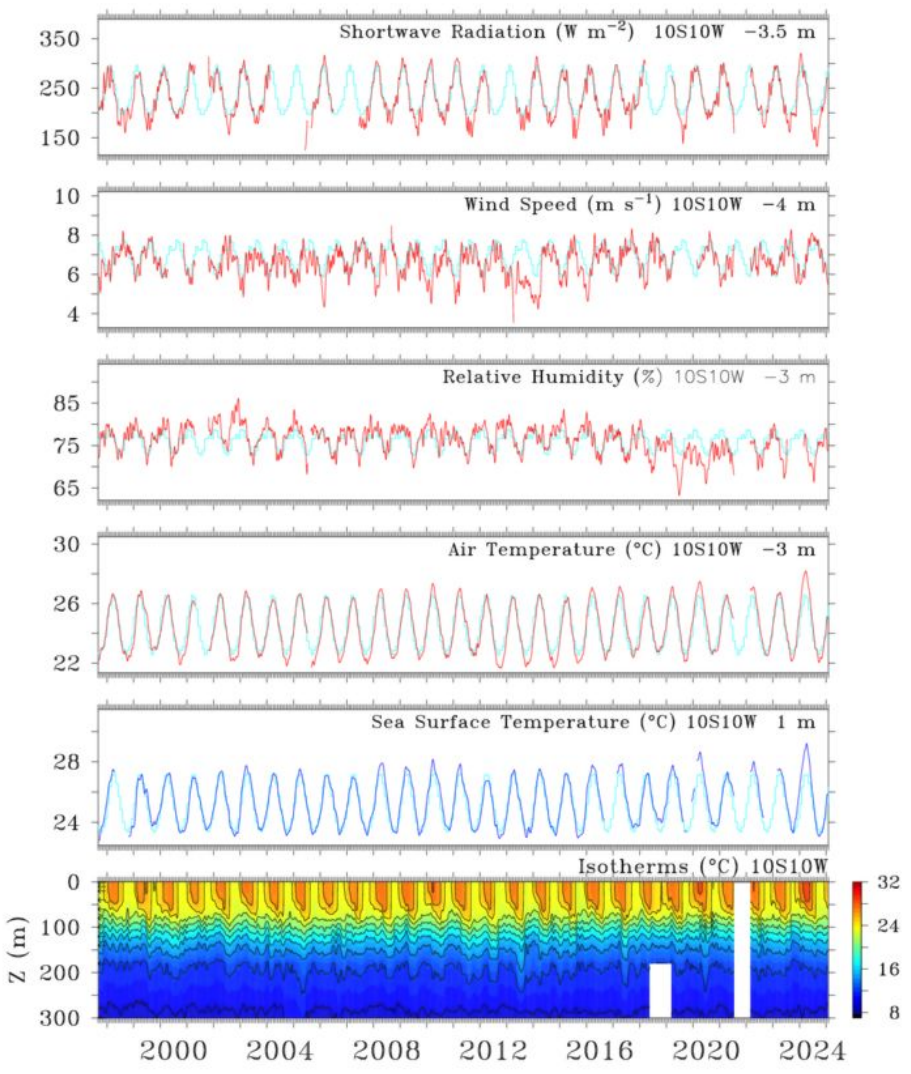
Buoys measuring surface meteorology, upper-ocean temperature, salinity, currents in near real-time

PIRATA

Buoys measuring surface meteorology, upper-ocean temperature, salinity, currents in near real-time

400+

PIRATA publications since 1998

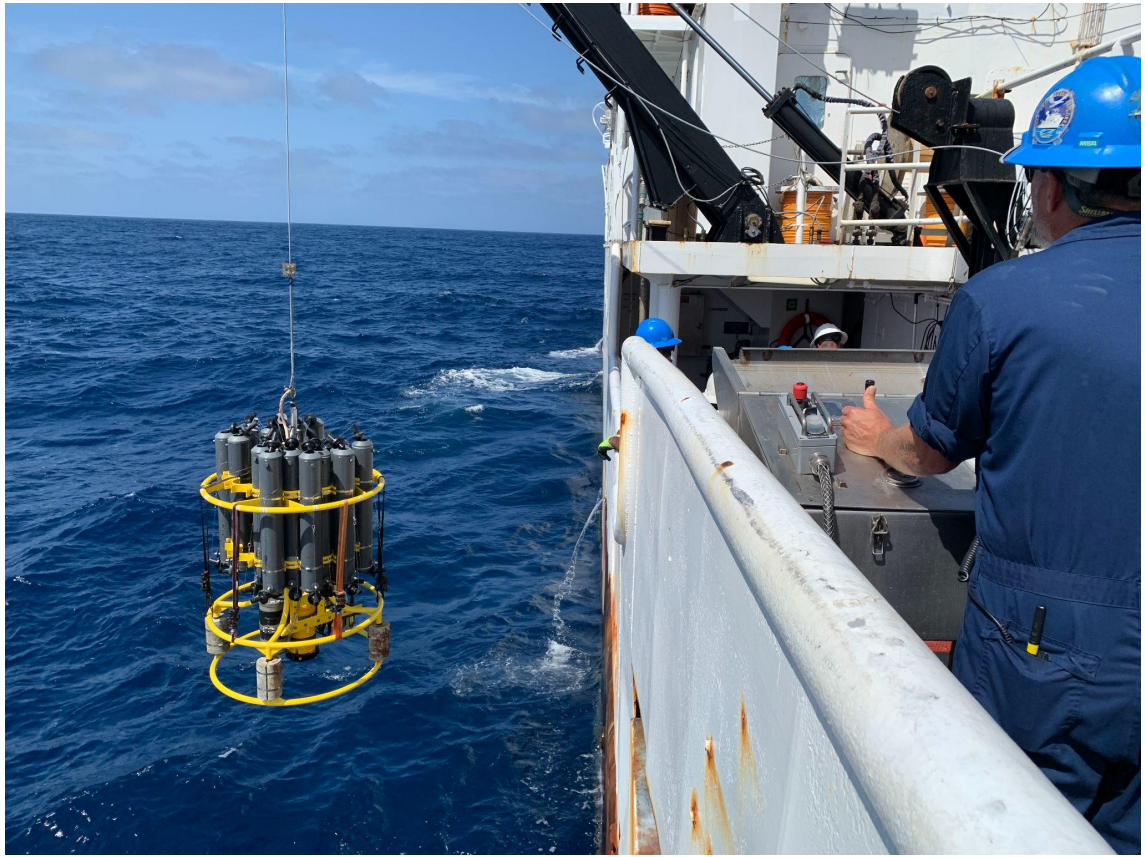


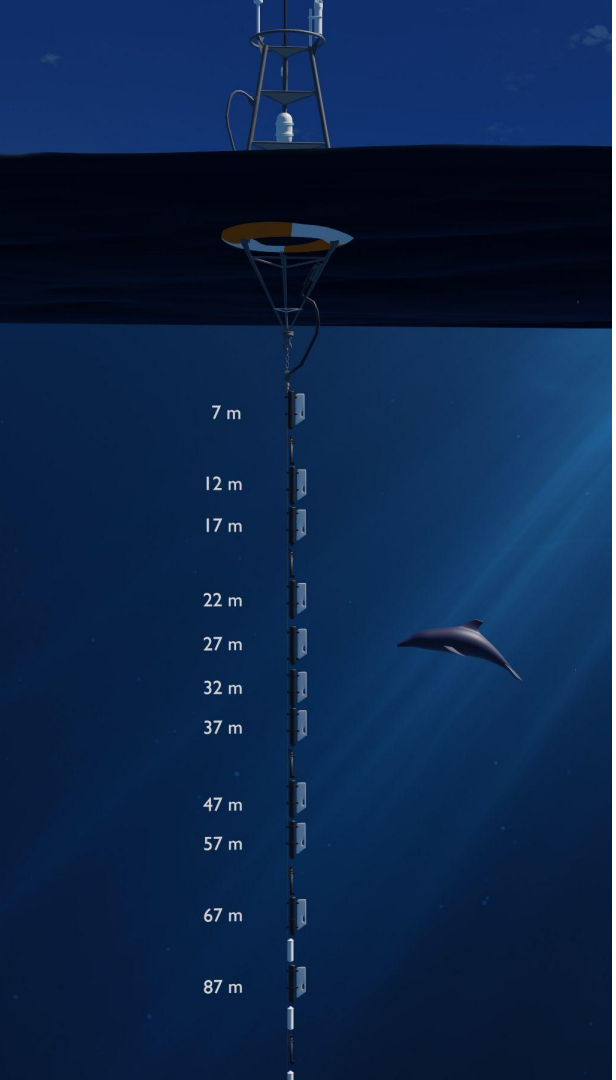
PIRATA

AOML leads annual research cruises with 60-70 CTD casts, drifter, Argo, radiosonde, and ozonesonde deployments, and Sargassum/nutrient sampling

17

Cruises since 2006



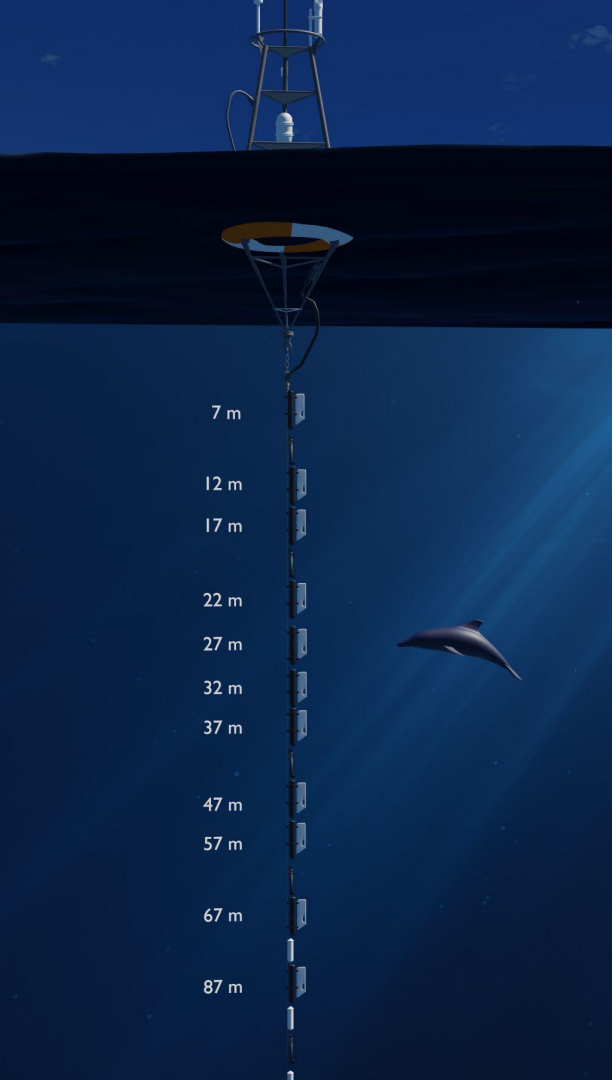


TACOS

Tropical Atlantic Current Observations Study

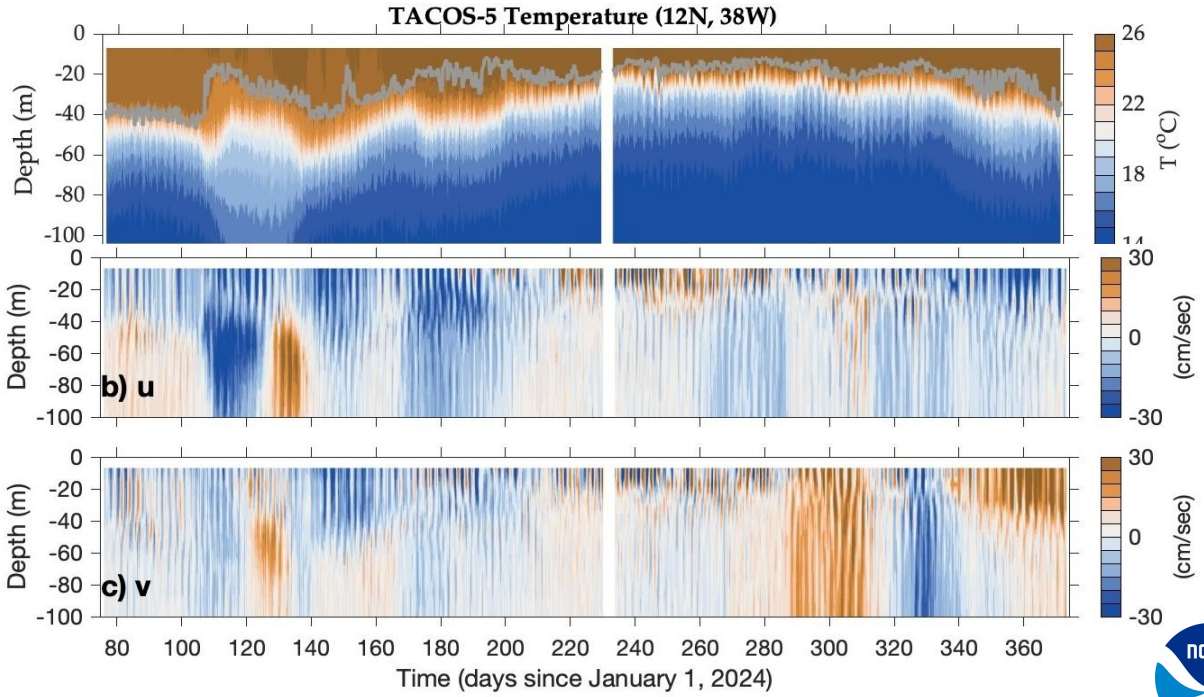
Focused on advancing understanding of ocean circulation and mixing and its impact on sea surface temperatures and the atmosphere.

Since 2017, TACOS provides time series of ocean currents and vertical shear in regions with strong ocean-atmosphere coupling.



TACOS

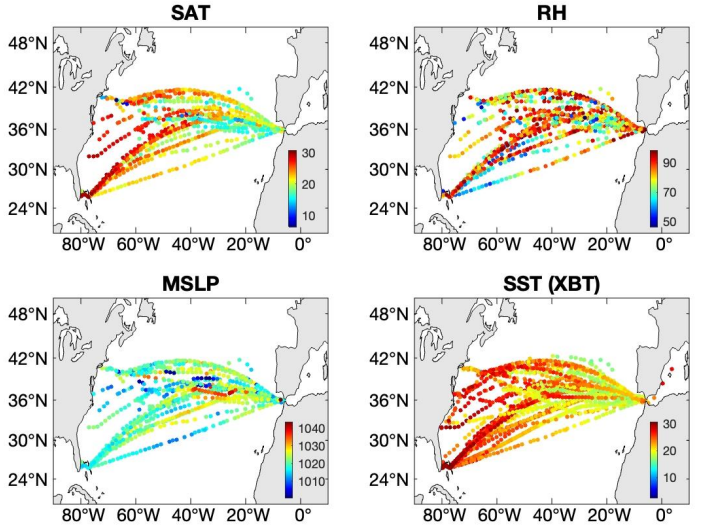
Study eddies, inertial currents, diurnal variability, tropical instability waves, wind- and buoyancy-driven currents, etc.



Surface Meteorological Data along XBT Transects

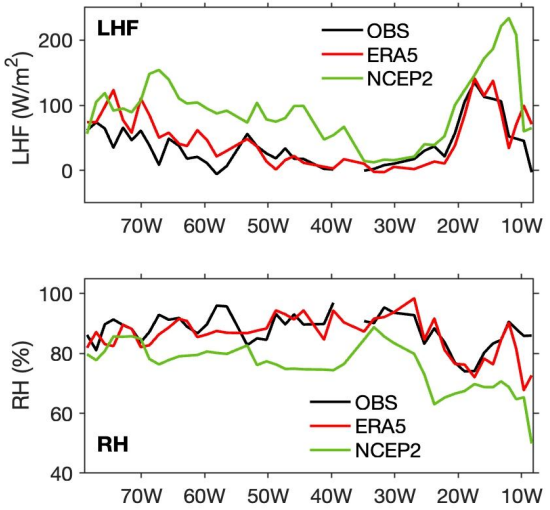
Innovation

Weather station designed by AOML engineering group.



Observations

Surface air temperature (SAT), relative humidity (RH), and sea level pressure (MSLP) from weather and sea surface temperature (SAT) from XBTs.

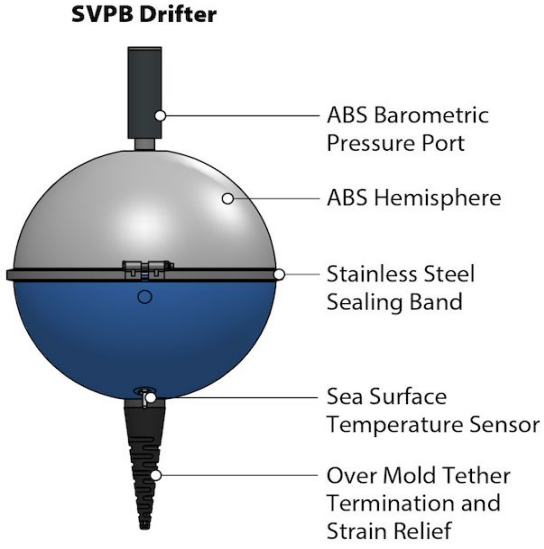


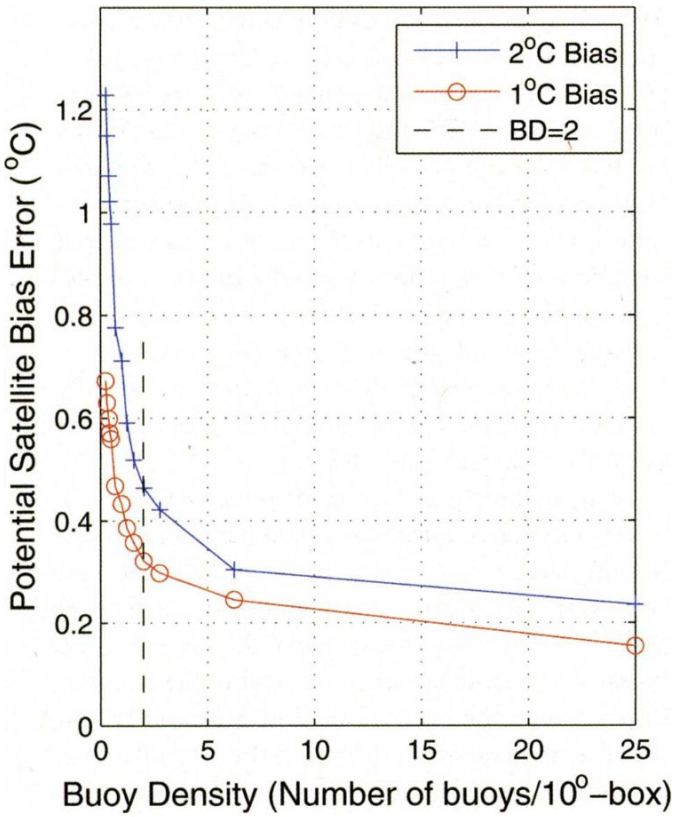
Application

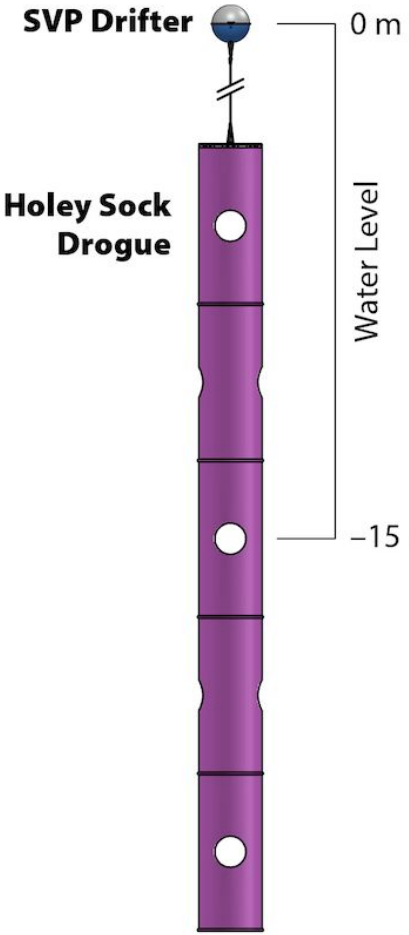
Latent heat flux (LHF) derived from observations (OBS) used to examine biases in reanalysis LHF (mainly due to RH biases).

Surface Drifting Buoys

Surface drifting buoys provide more SST observations than any other source of *in situ* data by a factor of 4 to 100 depending on the platform







Surface Drifting Buoys

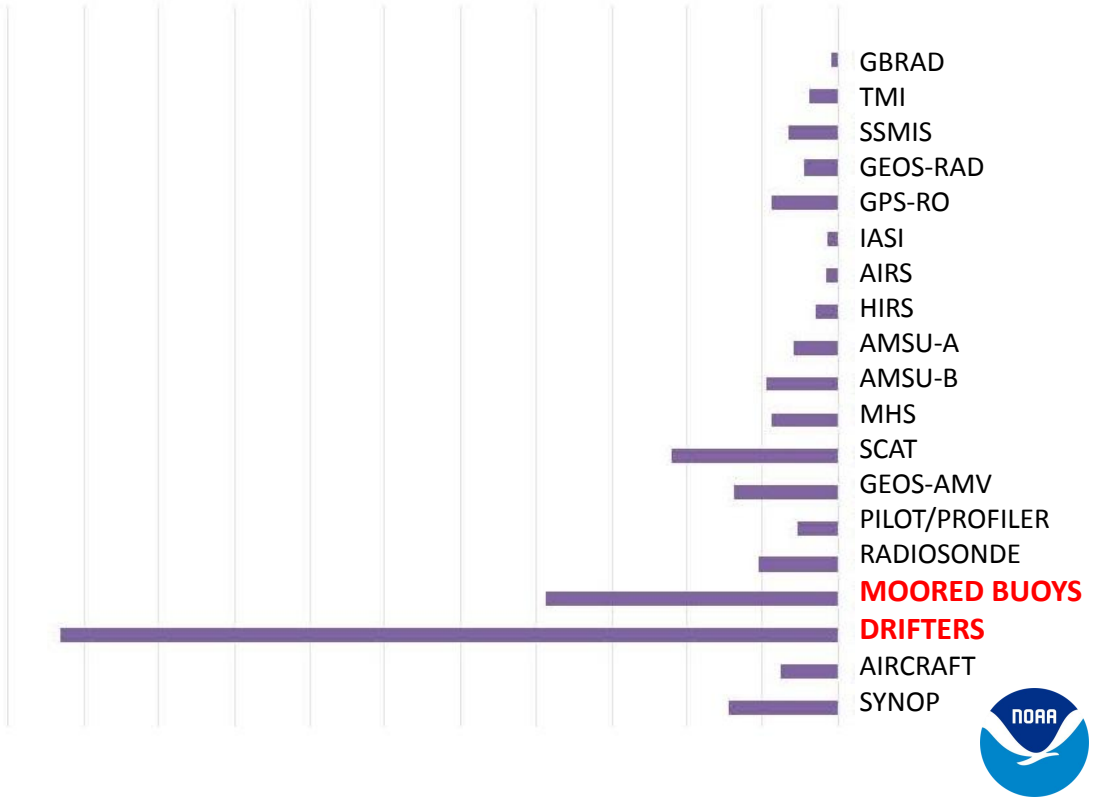
Sea-level pressure (SLP) drifter data are the most valuable per-observation Global Ocean Observing System contributor (Horanyi et al. 2017)

SLP observations anchor the global surface pressure field and significantly contribute to marine weather forecast accuracy (Centurioni et al. 2017)

1271

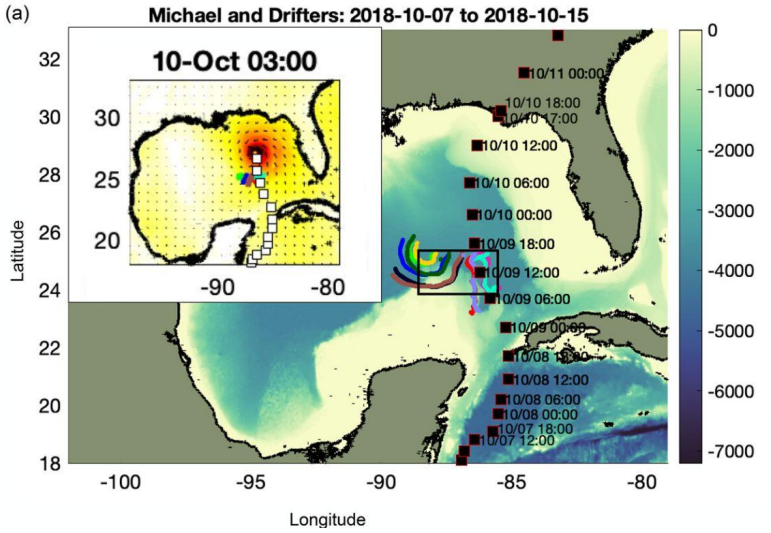
Drifter publications since 1974

European weather forecast sensitivity per data

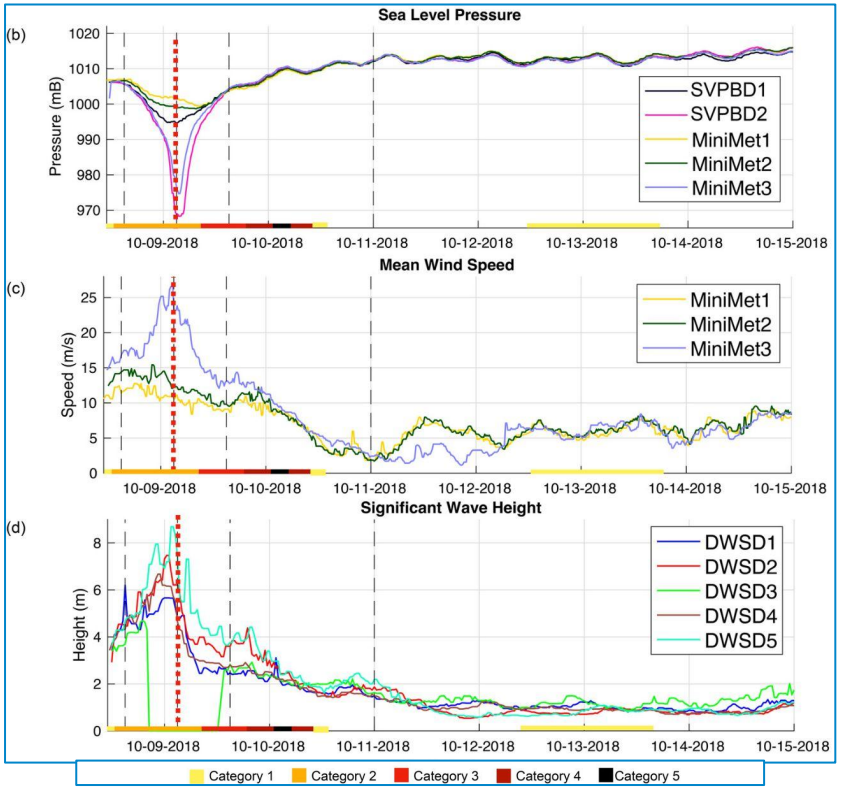


Surface Drifting Buoys

Air-deployed drifters in front of storms help monitor changes in ocean structure during storm passage and improve forecasts.



Drifter readings during Hurricane Michael (2018)

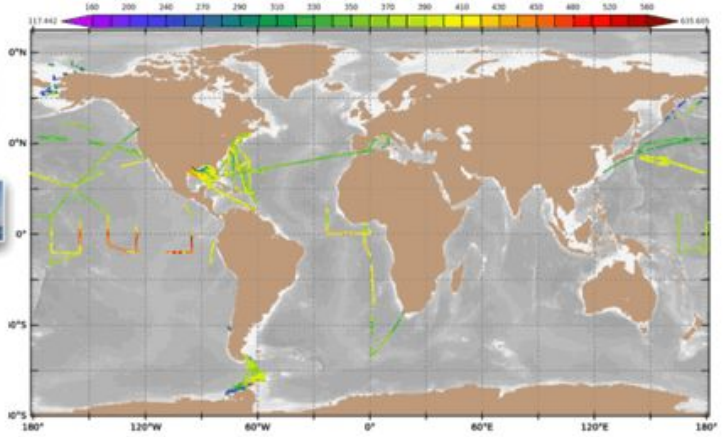


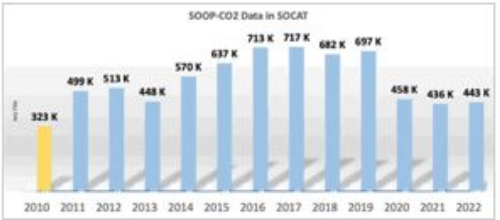
Ships of Opportunity (SOOP-CO2)

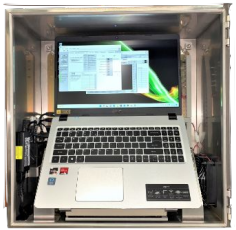
The fate of CO2 is monitored at the air-sea interface with:

- 600K data collected each year
- 5 partners
- 18 ships outfitted.

Technology transferred to General Oceanics. Gold standard system used worldwide (>200 systems)





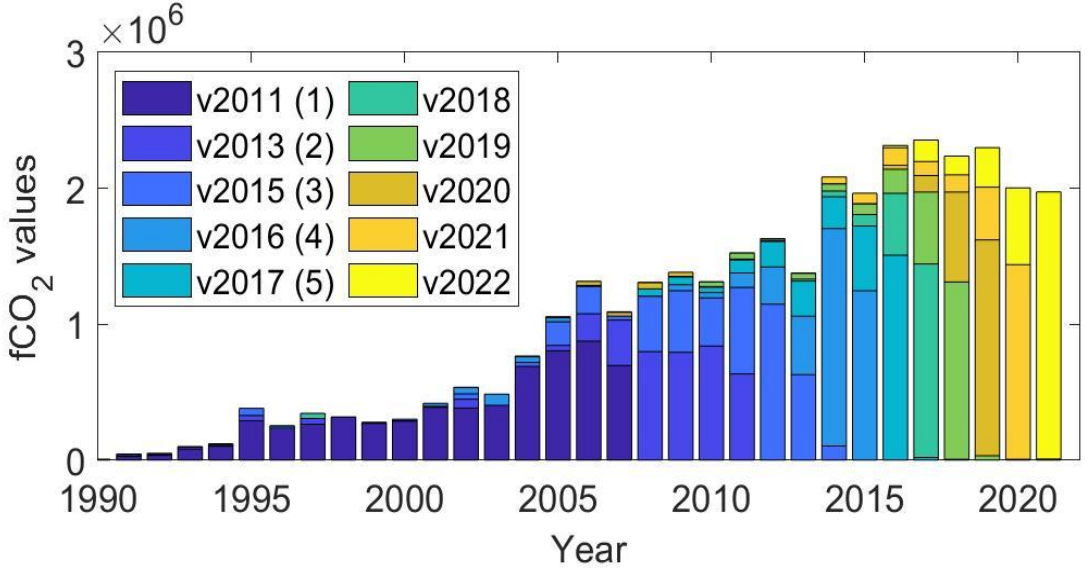


Ships of Opportunity (SOOP-CO2)

Quality-controlled data are made public by volunteer scientists using tools provided by the Surface Ocean CO2 Atlas, SOCAT.

AOML co-founded the SOCAT and is a major data contributor.

AOML surface CO2 data are incorporated on a yearly basis into global products and scientific assessments.



SOCAT · SURFACE OCEAN CO2 ATLAS ·

NOAA

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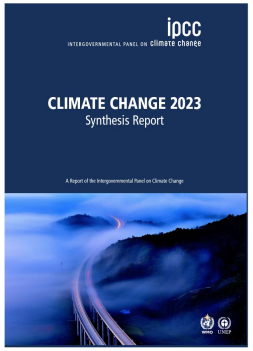
Global Carbon Budget



IPCC report

State of the Climate

725+

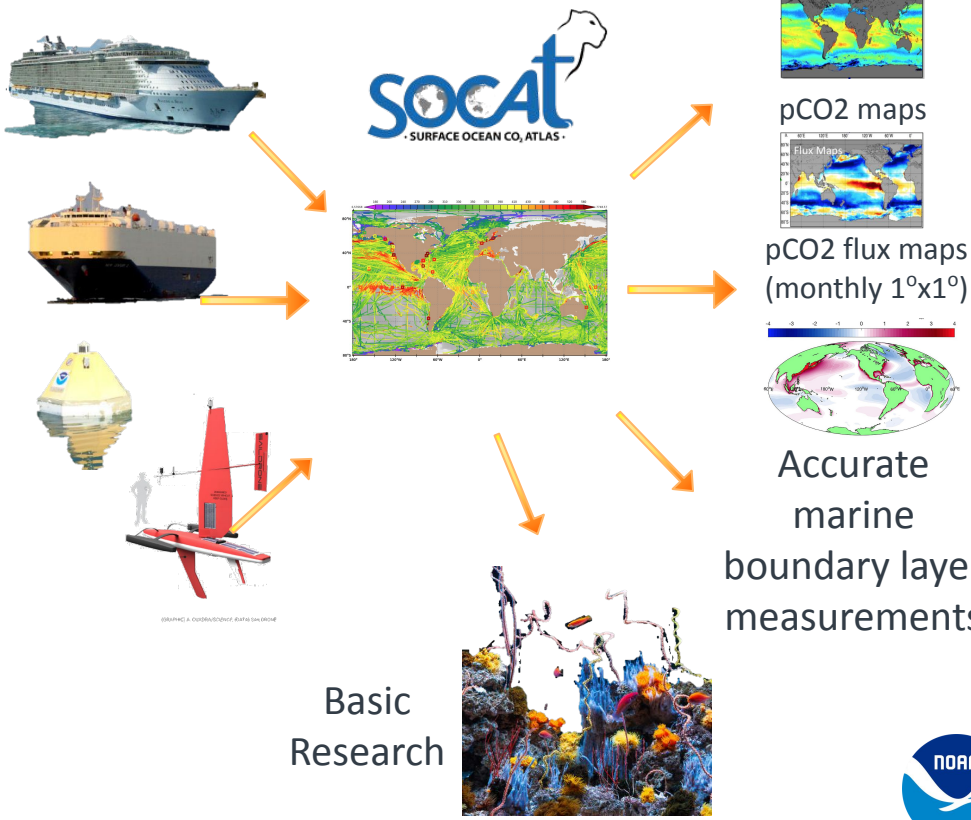
SOCAT publications since 2008

Transition to SOCONET

Created in response to international urgency to increase CO2 monitoring

- Global Climate Observing System
- World Meteorological Organization

A distributed network has been established to intercompare surface CO2 data sets and create high-accuracy global CO2 concentration and flux maps.



Resources and Partners

Key Takeaways

01 AOML's air-sea observations enhance understanding of a wide variety of societally-relevant phenomena.

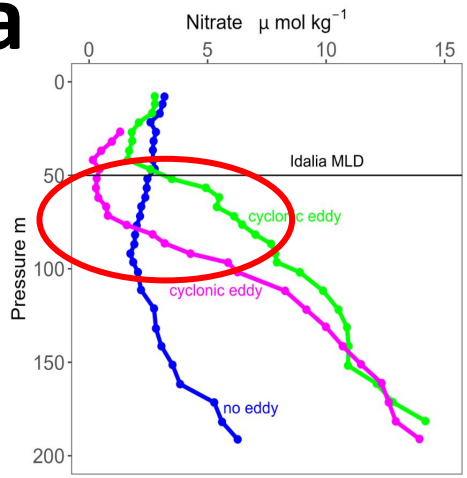
02 Continuing these programs allows us to collect more interdisciplinary measurements.

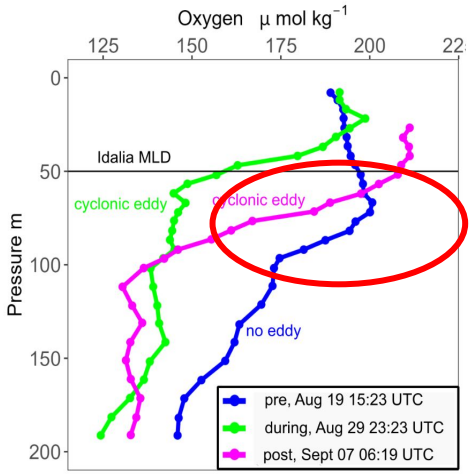
03 AOML's observational programs should explore opportunities for technological innovation, leveraging recommendations from observing system reviews.

Ocean BGC response to Hurricane Idalia

Saildrone and BGC Argo observe enhanced productivity (surface chlorophyll bloom), nitrate utilization, oxygen production during Hurricane Idalia

BGC Argo





Saildrone