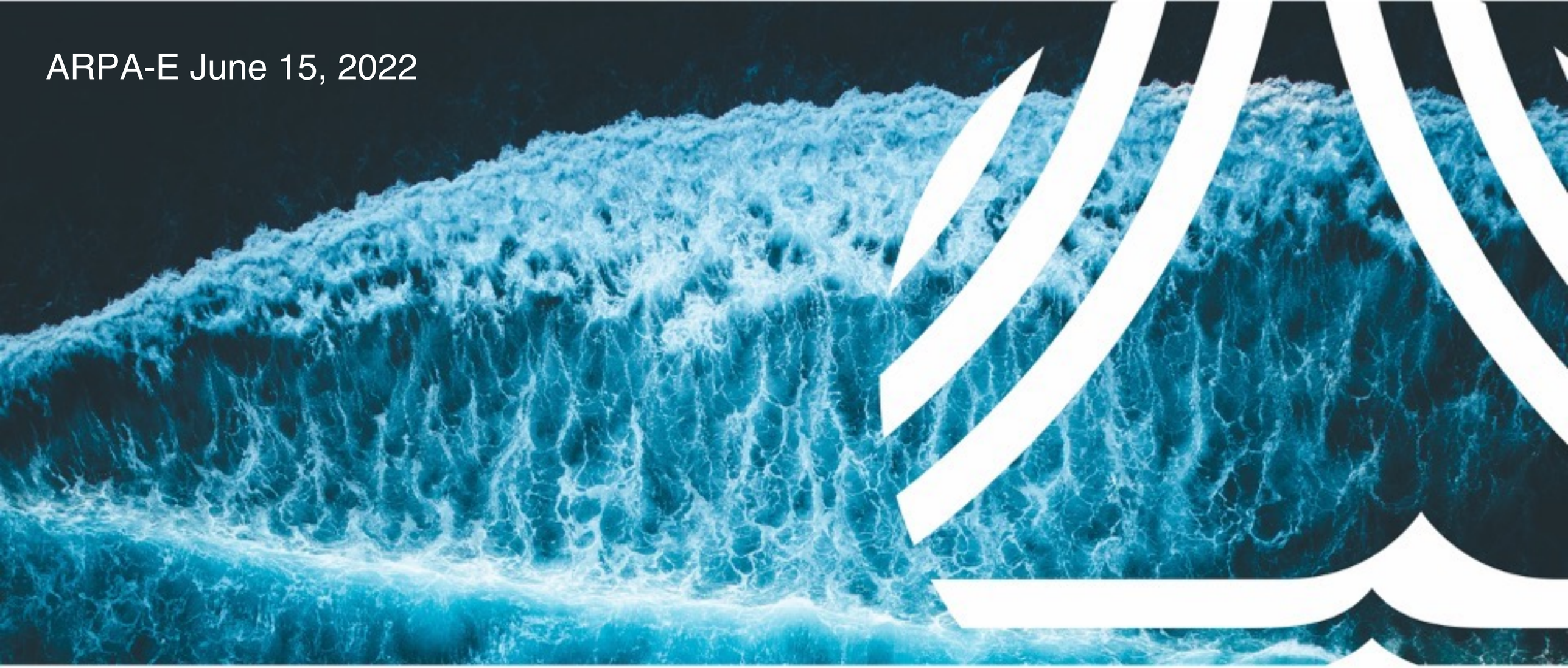
ARPA-E June 15, 2022



Ocean Vital Signs Network

Peter de Menocal, President and Director

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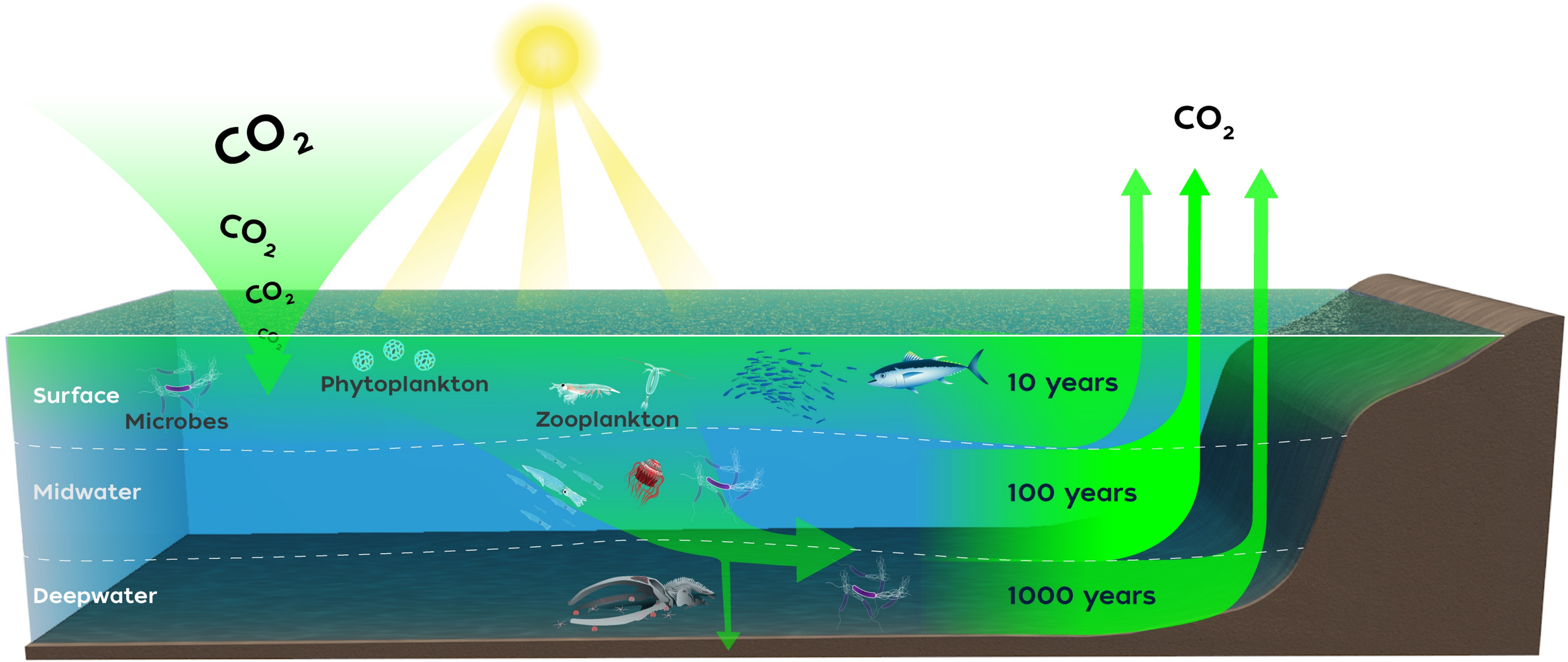
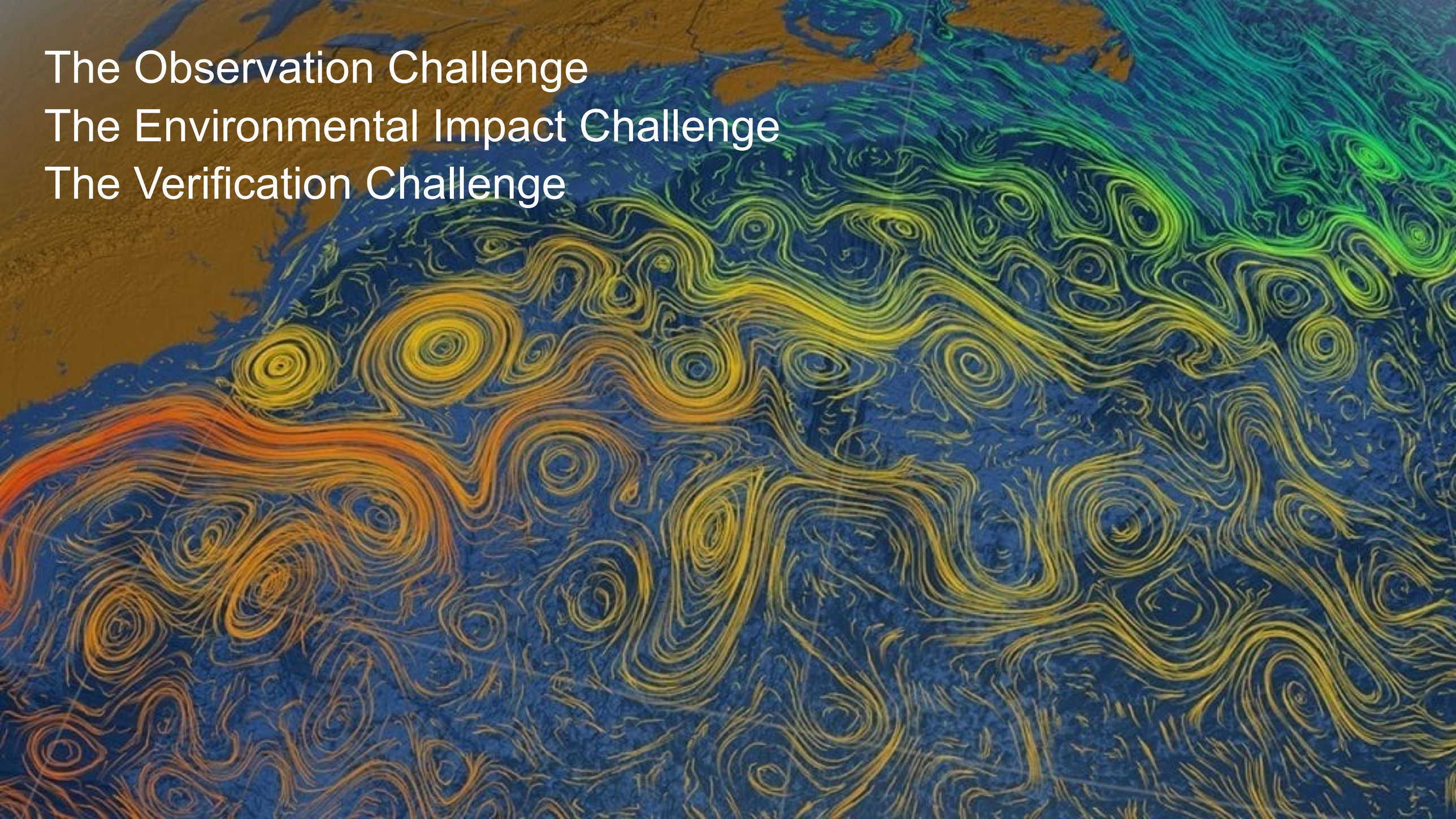
WHOI Vision Plan

“All pathways that limit warming to 1.5°C require CDR”

IPCC AR6 report (2021)

Net-zero needs the ocean




The Observation Challenge
The Environmental Impact Challenge
The Verification Challenge

Ocean Vital Signs Network

Challenge

Observe, monitor, verify deep ocean carbon fluxes at scale.

Solution: “Ocean data cube”

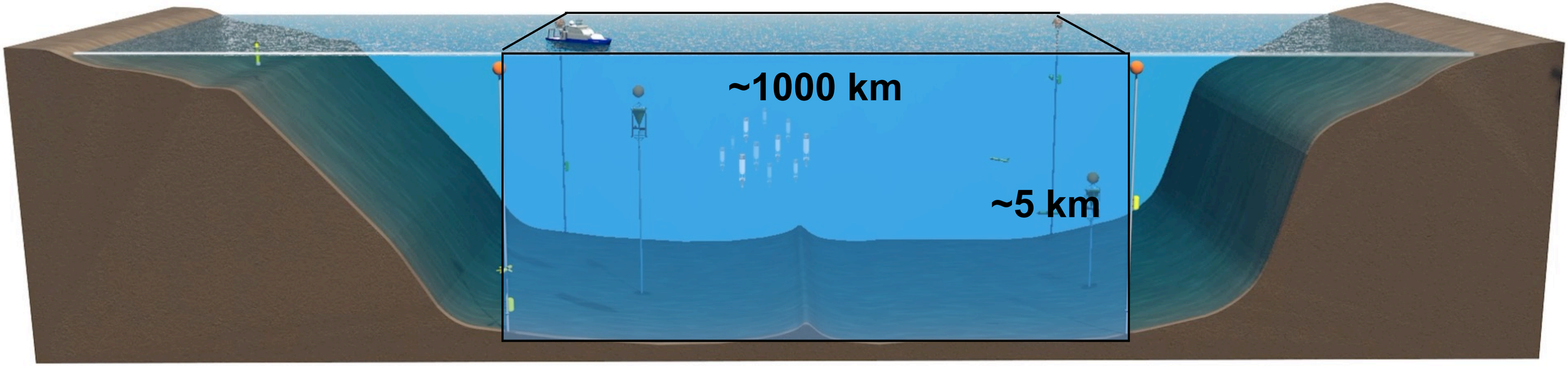
Nominal one million km^2 x full ocean depth

Goals

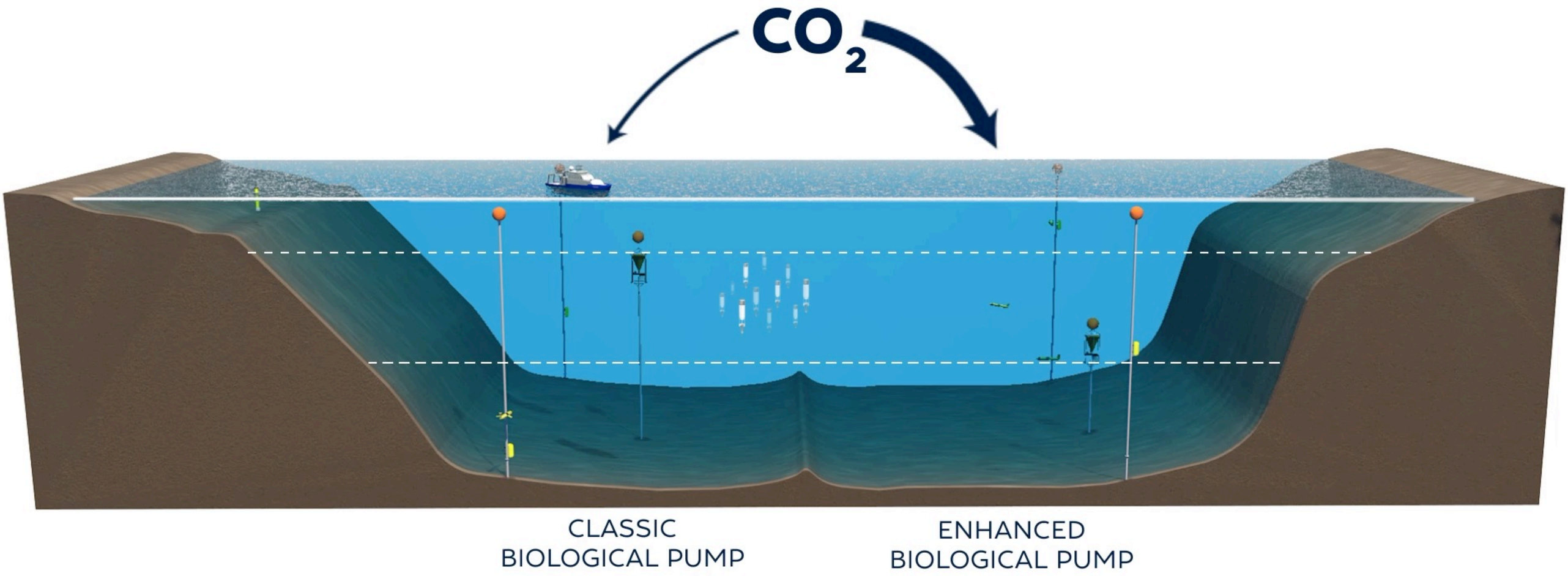
1) Measure and verify deep carbon export
2) Track ocean health and ecosystem function
3) Collaborative ”Sand Box” for OCR strategies

OVSN Concept – An “ocean data cube”

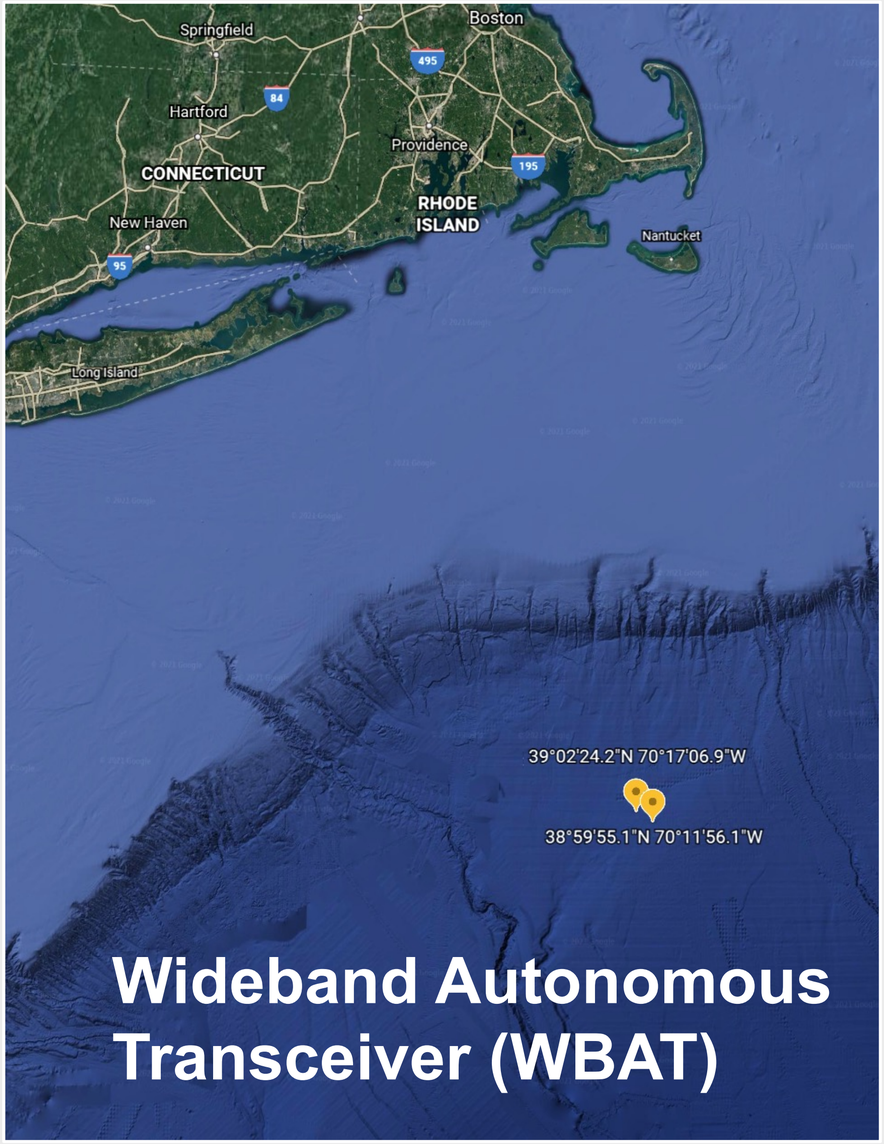
Always-on, always-connected, ocean “Internet of Things”
Measure properties constraining ocean health, function and carbon flow

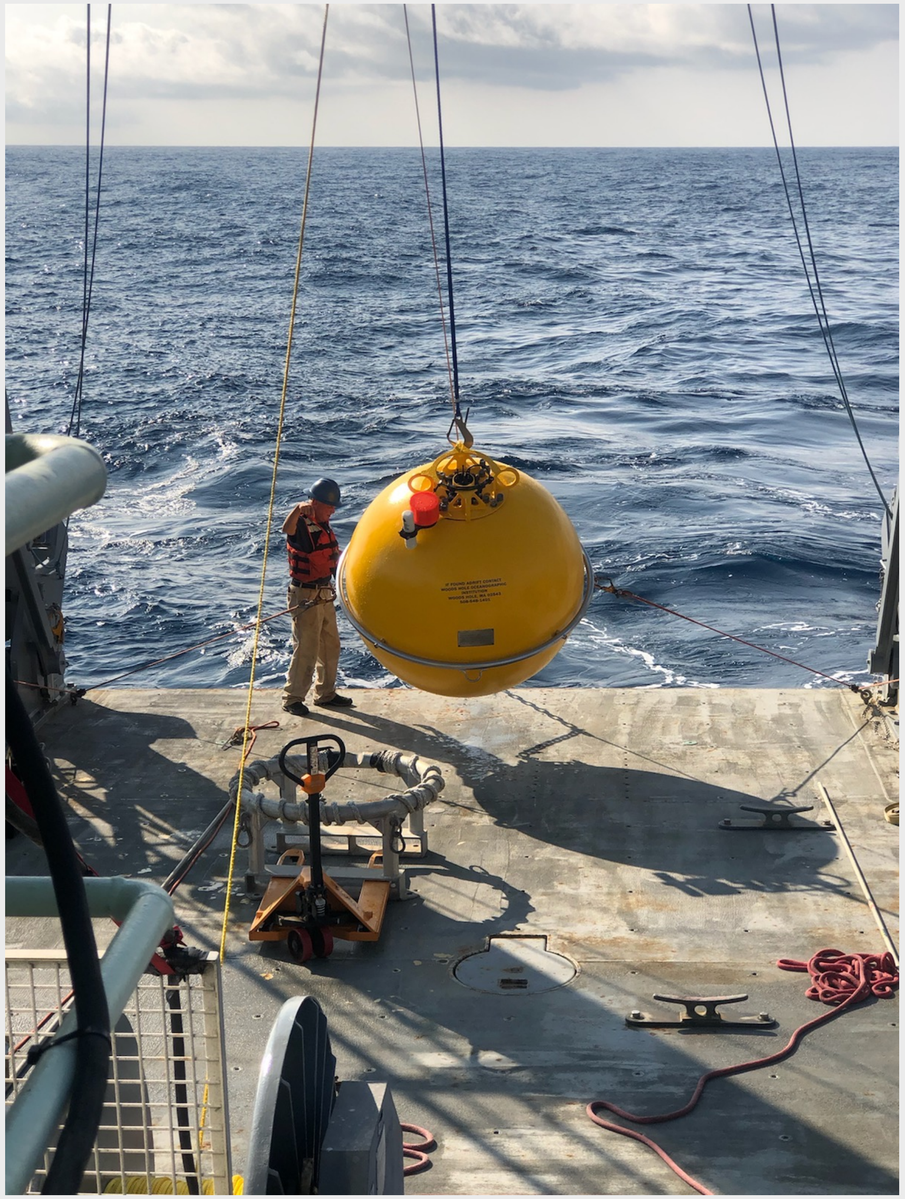


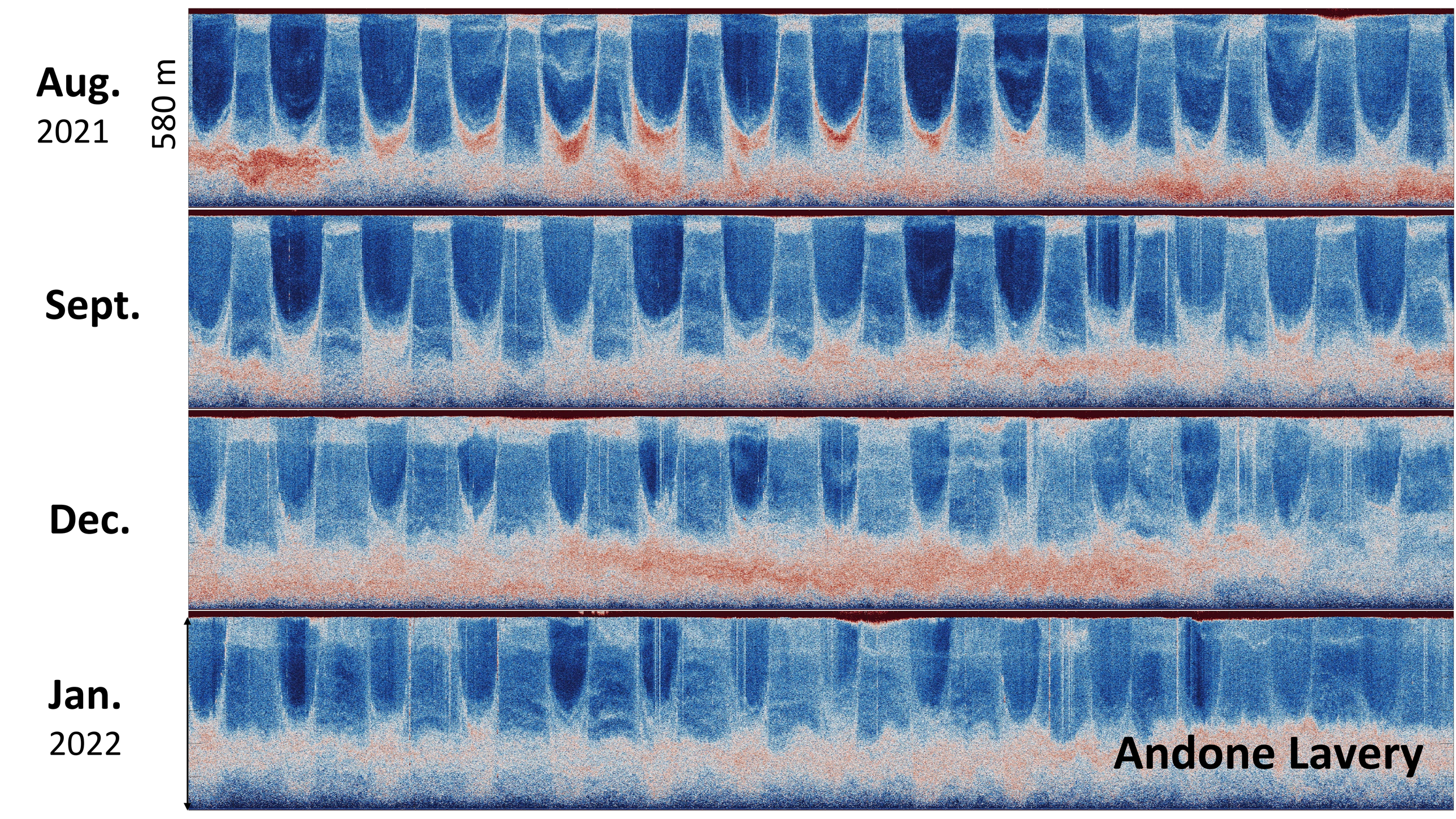
OVS Network in action



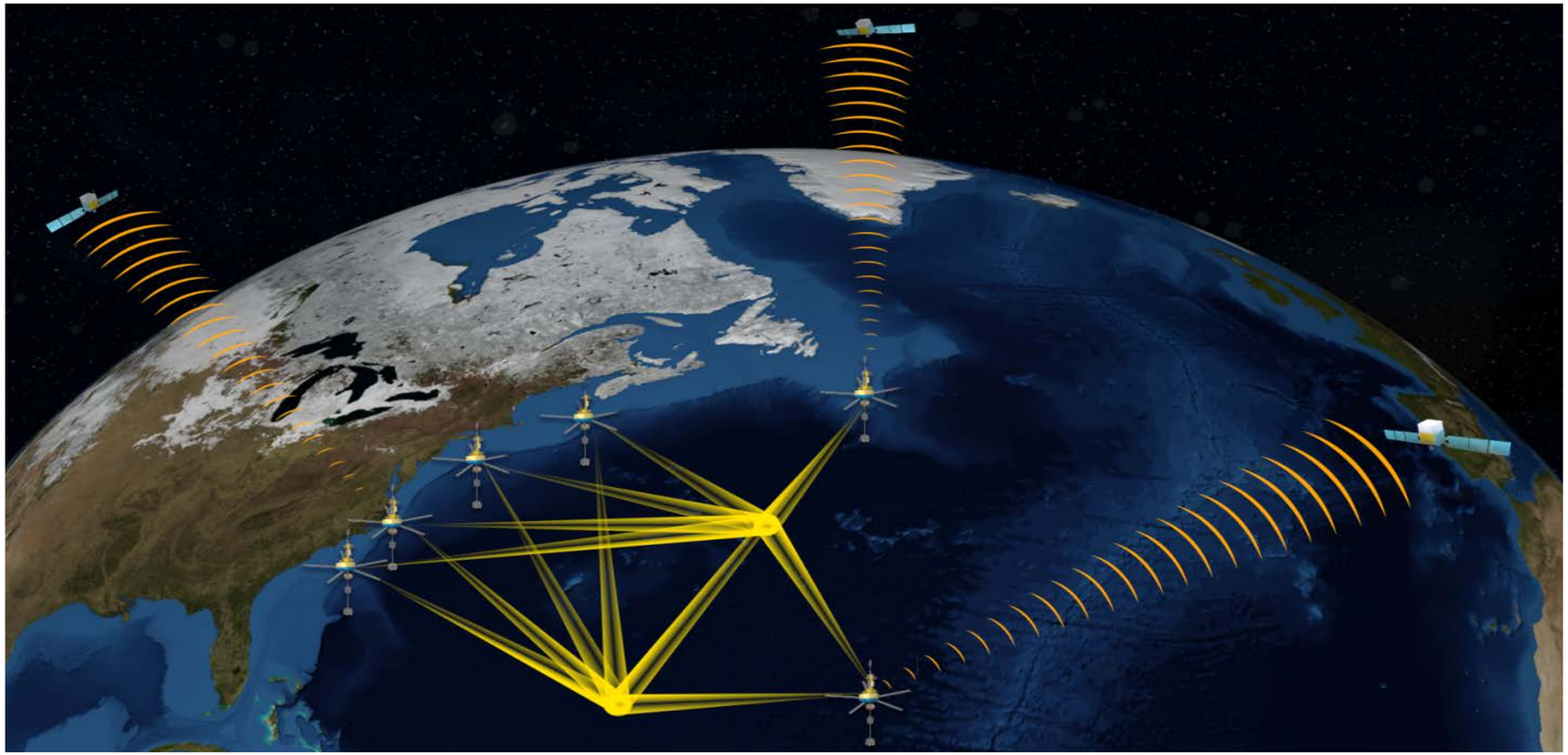
Imaging deep ocean ecosystem biomass






Aug.
2021
580 m
Sept.
Dec.
Jan.
2022
Andone Lavery

Phased-Array Acoustic Telescope

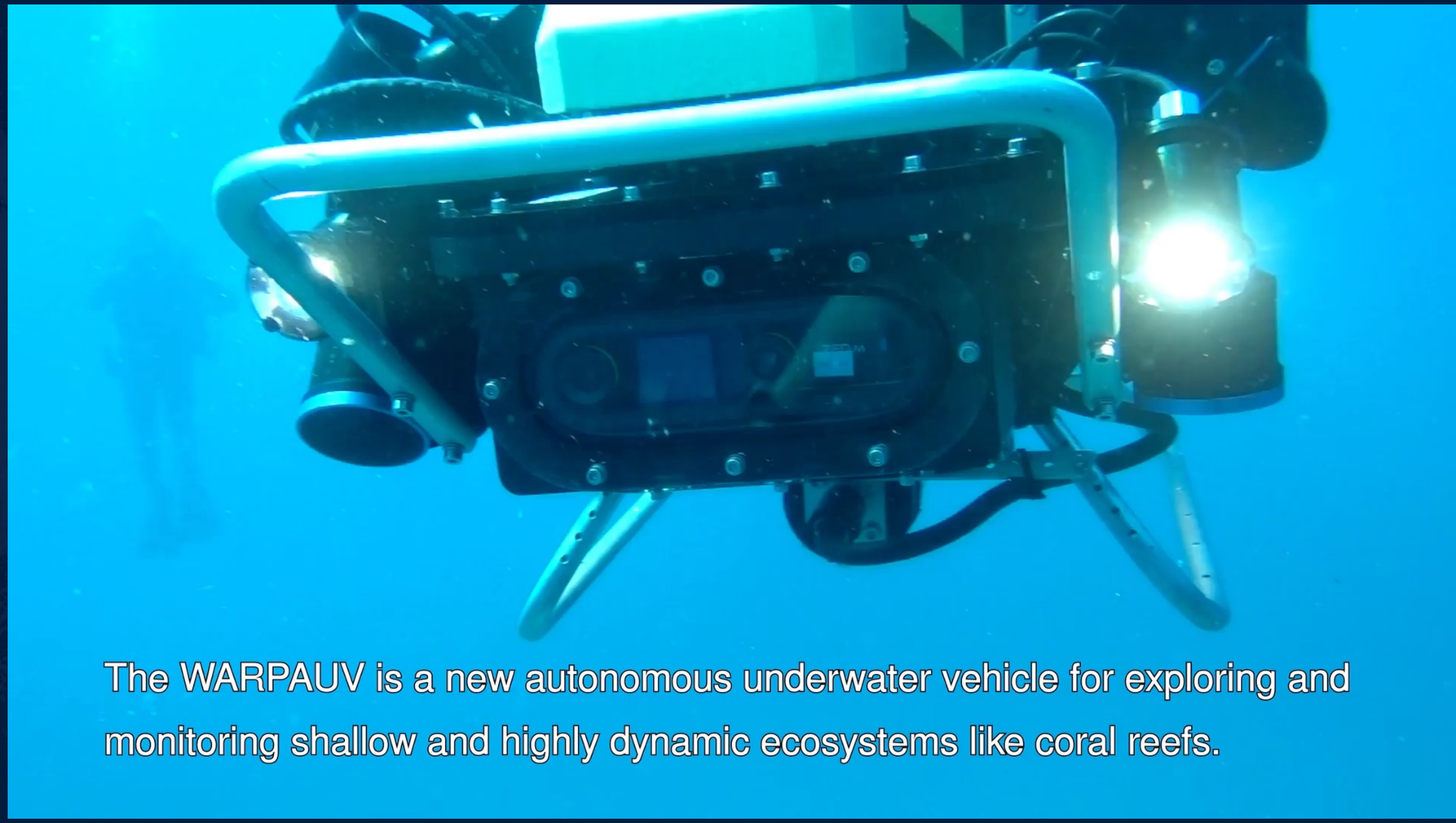


Ocean Holography (and Wi-Fi)

YT Lin

Edge Computing and Marine Robotics

Yogi Girdar



The WARPAUV is a new autonomous underwater vehicle for exploring and monitoring shallow and highly dynamic ecosystems like coral reefs.

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The Curious Robot

Some Innovation Areas

Enabling technology

- Power management & generation
- Cloud computing and AI/ML tools
- High bandwidth Acoustic/Optical comms
- 5G buoy comms – Burst comms
- New vehicles, intelligent & curious

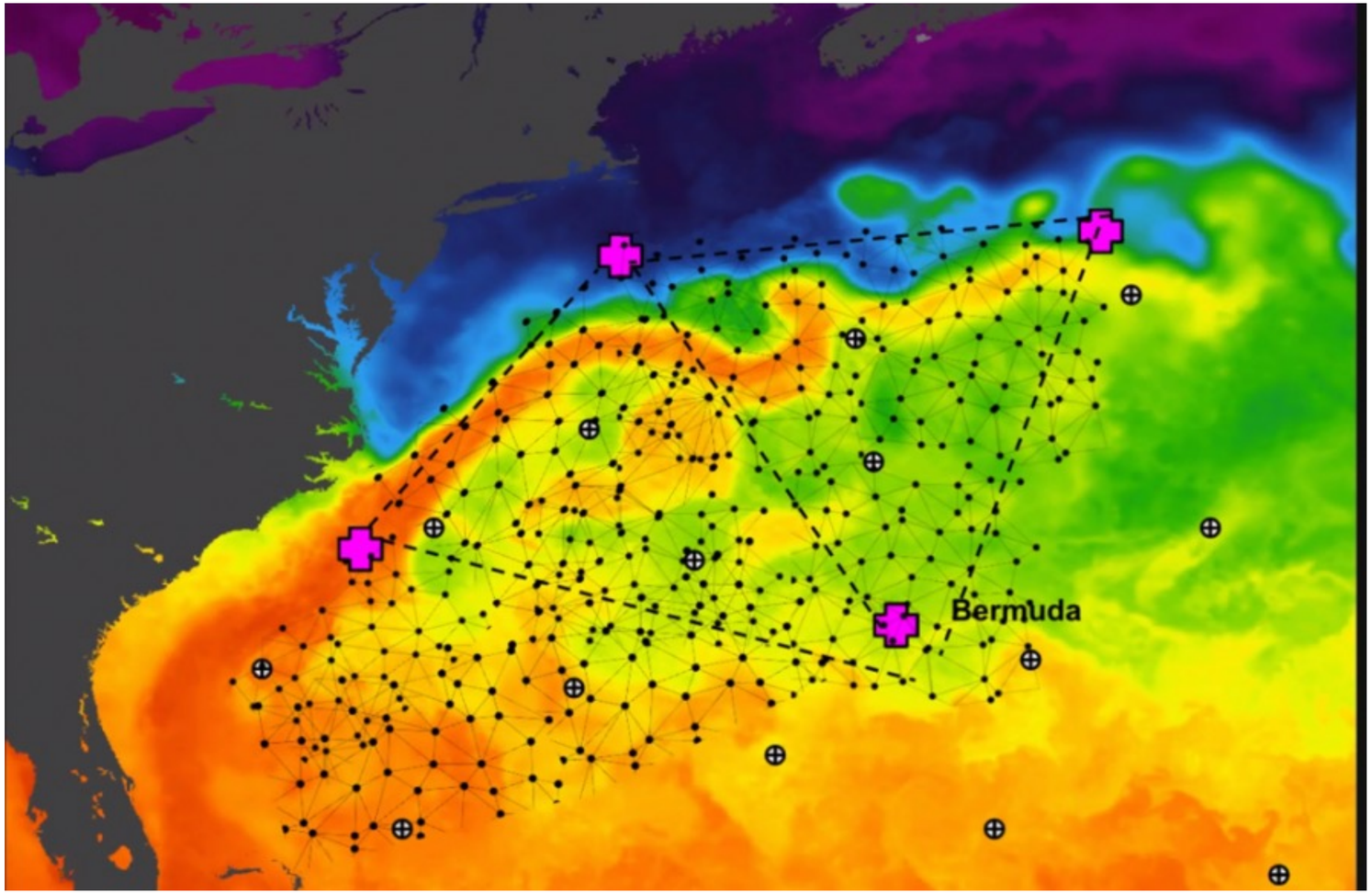
Sensing

- Imaging & Acoustics (active and passive)
- e-DNA, -‘omics
- New sensors for DOC/POC carbon system
- Autonomous traps/ sinking flux measurements
- Bioacoustic flux estimates

Data and Modeling

- Data management & sharing
- Network optimization
- Observing System Simulation Exp.
- Data assimilation/state estimation
- Process modeling
- Scenario simulation
- Digital Twin

OVSN Conceptual Design



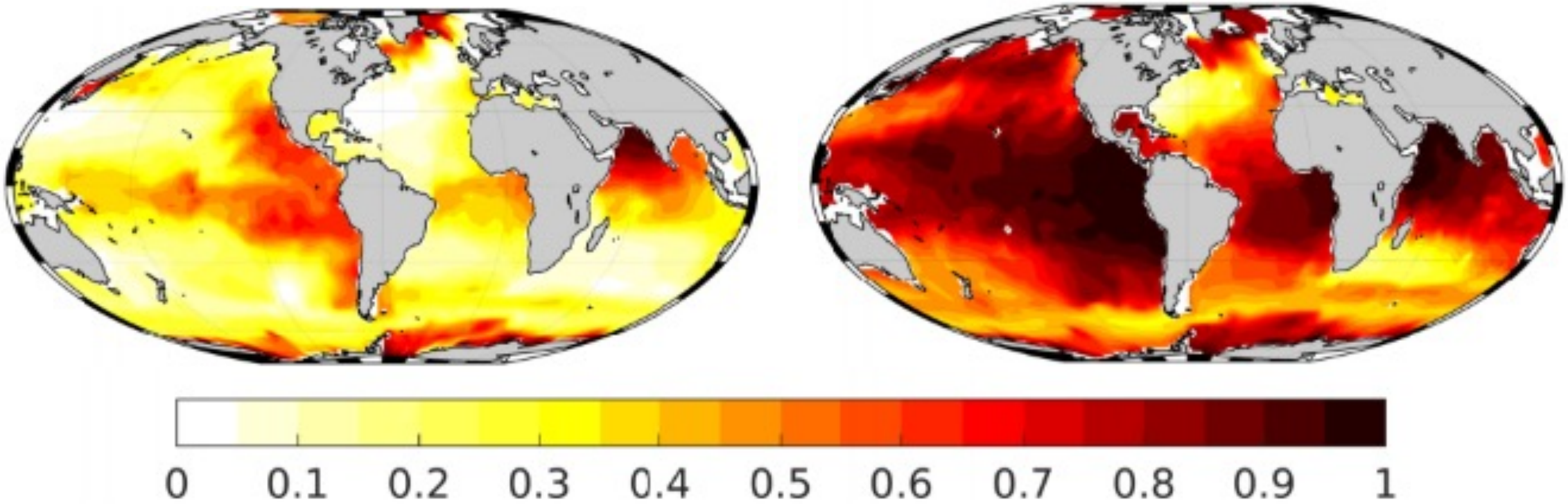
high-resolution monitoring at the **regional scale**, nested within a **global backbone** of ocean observations and models

Where to deploy OVSN ?

Carbon must get below 1000 meters

500 meters

1000 meters



Fraction of carbon stored for greater than 100 yrs

From Siegel et al., 2021

OVSN – Current Status

- **OVSN Framing Committee** (Spring 2022)
  - Identify driving science questions
  - Define knowledge and technology gaps
  - Science plan & timeline

- **Investing in science innovation**
- **Build partnerships**
- **Funding:** $2M → $20M → $200M

Building Partnerships

Federal

Industry

Research & Education

International

Philanthropy

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Take away – Science must lead solutions

Thank you.