National Oceanic and Atmospheric Administration
US Department of Commerce

OCB Summer Workshop 2023
Woods Hole, MA
16-20 October 2022

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Ocean Carbon, Biogeochemistry, and Sea Level Observations
Global Ocean Monitoring and Observing Program

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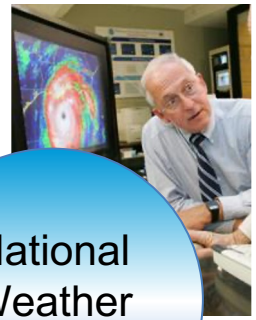
Carbon Dioxide Removal Program Co-Lead
Ocean Acidification Program

NOAA Line Offices



National Ocean Service

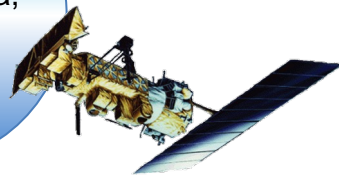
National Weather Service

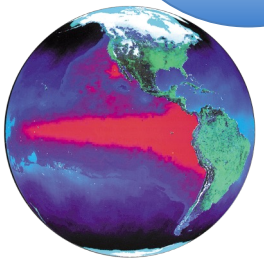
National Fisheries Service

National Environmental Satellite, Data, and Information Service

NOAA Research (OAR)

Marine and Aviation Operations





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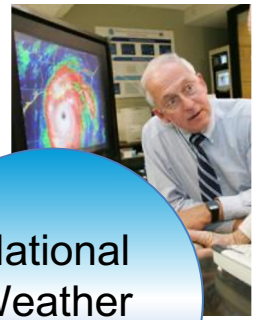

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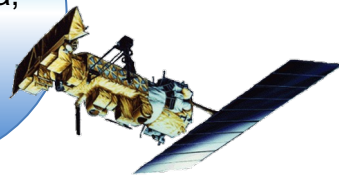


MISSION: ***Research, Develop, Transition.*** **Conduct research to understand and predict the Earth system; develop technology to improve NOAA science, service, and stewardship; and transition the results so they are useful to society.**

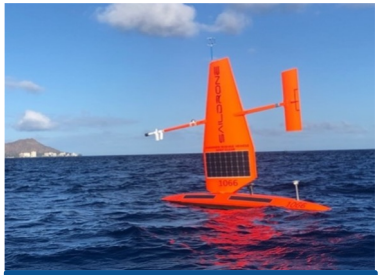
NOAA Global Ocean Monitoring and Observing Program (GOMO)

Director: David Legler

MISSION: To provide and support high-quality global ocean observations and research to improve our scientific understanding and inform society about the ocean's role in environmental change.

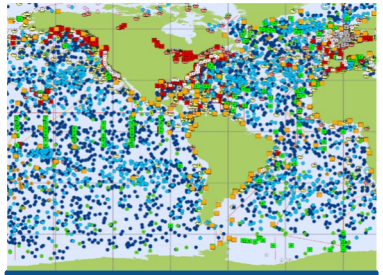
GOAL 1

Sustain global ocean monitoring and observing for long-term continuity and improve data quality and system efficiency.



GOAL 2

Innovate & evolve the ocean observing network to address emerging needs & opportunities for ocean health, ocean economy, weather & climate.



GOAL 3

Improve the value, accessibility, and usability of observational data for informed decision-making.

GOAL 4

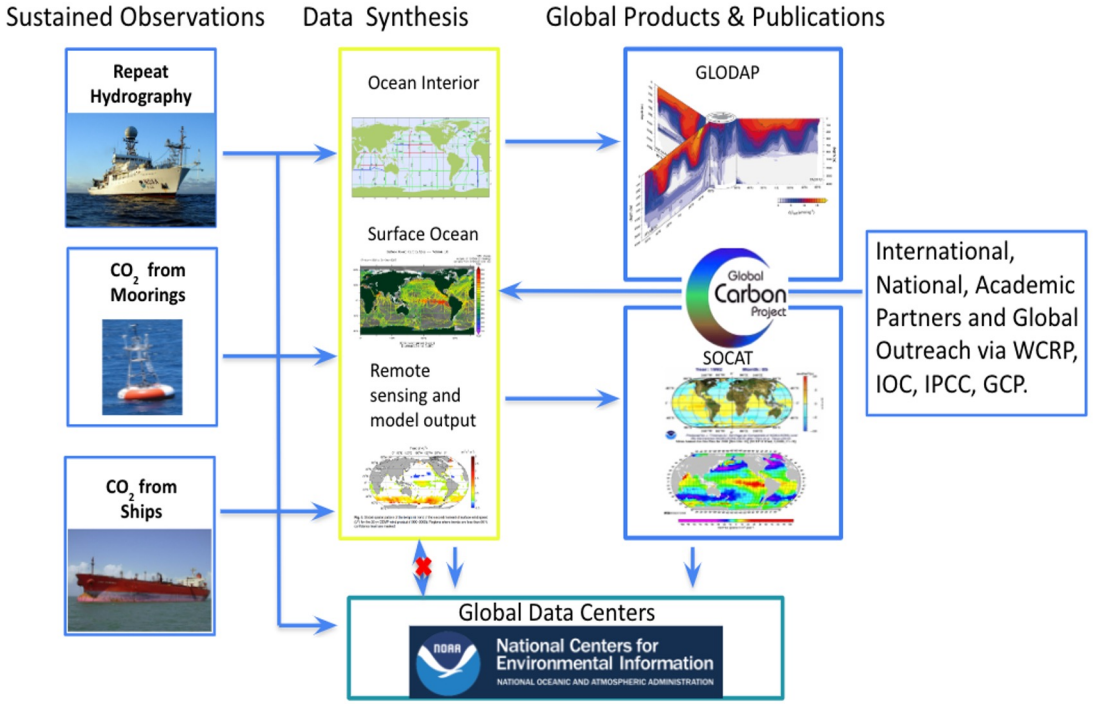
Develop and capitalize on the expertise and capacity of the ocean observing enterprise.

GOMO Global Ocean Carbon Observing Network

Providing long-term observations of carbon from the sea surface to the interior at a range of spatial and temporal scales.

Strategy

- Repeat GO-SHIP cruises (NSF, NASA) with surface to bottom sampling;
- Fixed MAPCO$_2$ mooring stations;
- SOCONET Underway pCO$_2$ measurements on research and volunteer observing ships.
- Average investment: $4.5 million (increased in FY2023 to $5 million)



GOMO Global Ocean Carbon Observing Network

Innovating and evolving observations of ocean carbon and biogeochemistry

SOCONET

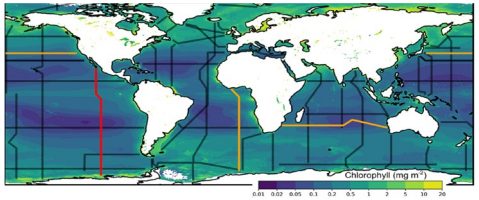
• SURFACE OCEAN CO_2 OBSERVING NETWORK •

A distributed reference network with ~40 partners worldwide

Outcomes

- ★ Expand global observations of air-sea CO_2 fluxes (planned, FY2024)
- ★ Create annual updates of ocean carbon uptake
- ★ Enable countries to assess progress towards achieving the long-term goals of the Paris Climate Agreement.

Bio-GO-SHIP Pilot Project

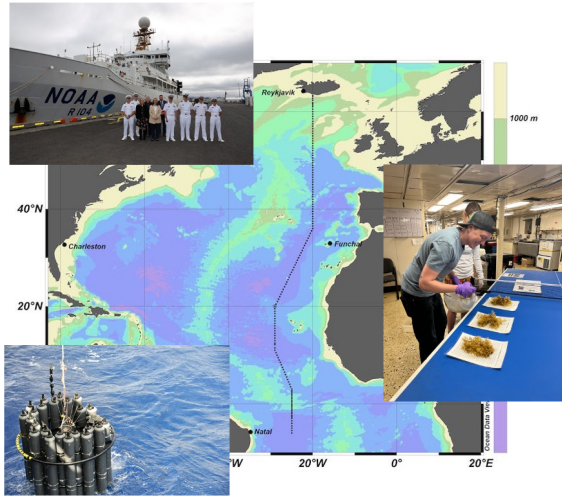


Outcomes

- ★ Quantify the impact of biological processes on the carbon, oxygen and nutrient cycles
- ★ Characterize the distribution of global biodiversity

NOPP Supported by GOMO, IOOS, OER, NASA

GO-SHIP A16N



Outcomes

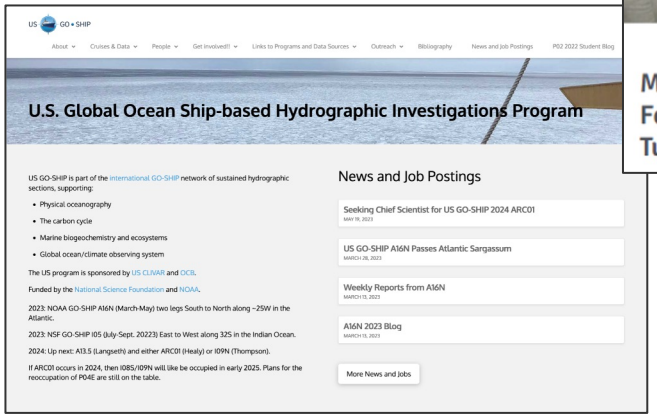
- ★ 150 stations re-occupied (30 years of data), 3000 depths
- ★ Bio-GO-SHIP sampling
- ★ 12 Argo floats (incl. BGC-Argo), 10 drifters

GOMO Capacity Building

Hosting students and early-career scholars

- ***Undergraduate***
  - Hollings Scholarship
  - Lapenta Student Internship
  - EPP/MSI Scholarship
- ***Graduate***
  - Knauss Fellowship
  - Dissertations Symposium in Chemical Oceanography (DISCO)
- ***Postdoctoral***
  - NSF-funded GO-SHIP postdoctoral fellowship
    - Serve as co-chief scientist
    - GOMO-funded companion fellowship in the future
- ***Cruise Opportunities***
  - https://usgoship.ucsd.edu/

Meet GOMO's new Knauss Fellows: Jessica Gwinn & Sarah Tucker



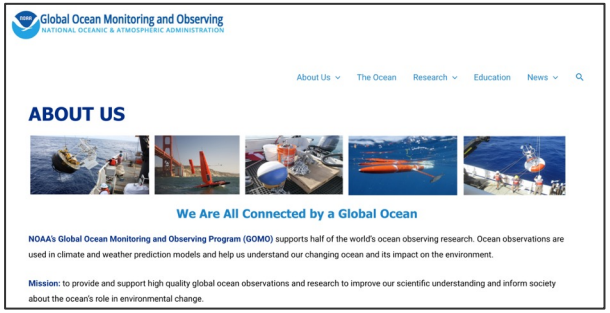
GOMO Workshops and Funding Opportunities

Supporting collaboration and research

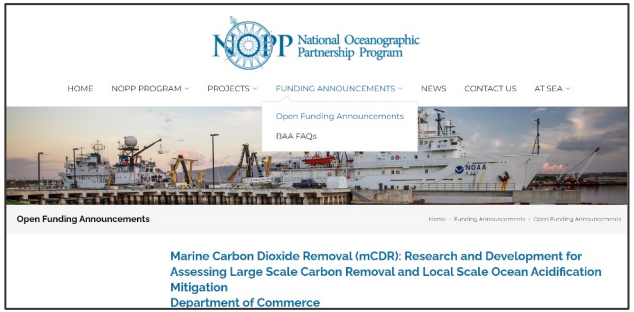
Workshops

- ***Instrumenting Our Ocean for Better Observation: A Training Course on a Suite of Biogeochemical Sensors***
  - Kristineberg, Sweden, June 5-17
  - Oxygen, POC, pH, pCO2, and Nitrate
- ***Biennial GOMO Community Workshop***
  - Silver Spring, MD, July 25-27 (hybrid)
  - https://globalocean.noaa.gov/gomo-community-meeting-2023/
- ***Surface Ocean CO_2 Workshop***
  - Oostende, Belgium, Nov 2023
- ***GO-SHIP Executive Council Meeting***
  - OSM, New Orleans, Feb 2024
- ***US CLIVAR Workshops***
  - Meeting AMOC Observing Needs in a Changing Climate (July 18-20)
  - Atlantic Tropical Variability and Tropical Basin Interactions (Aug 23)
  - Confronting Climate Model Trends with Observations (TBD)
  - Pathways Connecting Climate Changes to the Deep (TBD)
  - Optimizing Ocean Observing Networks for Detecting the Coastal Climate Signal (TBD)

Opportunities



https://globalocean.noaa.gov/news-events

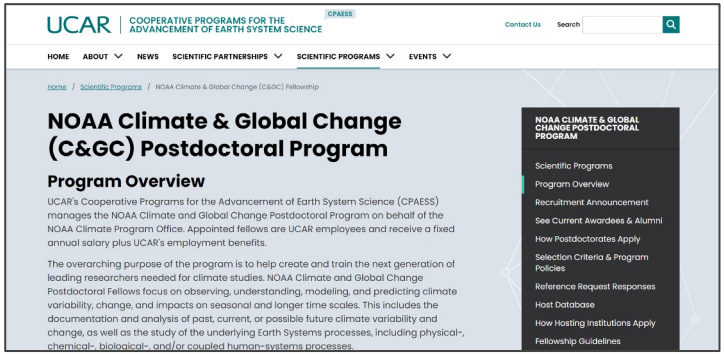


https://nopp.org/category/funding-announcements/open/

NOAA Climate Program Office (CPO)

- ***Competitive Research Funding***
  - **CPO Notice of Funding Opportunity, July**
    - CPO website, grants.gov, Earth System Science and Modeling Division (ESSM) newsletter
  - Previous (Closed) Opportunities
    - Innovative Ocean Dataset/Product Analysis and Development for support of the NOAA Observing and Climate Modeling Communities (COM and CVP programs)
    - Developing Datasets for Atmospheric Boundary Layer research through Observations and Modeling Community Collaborations (COM program)
    - Modeling Climate Impacts on the Predictability of Fisheries and Other Living Marine Resources (MAPP program)
    - Decadal Climate Variability and Predictability (CVP program)
  - Contacts: MAPP (Daniel.Barrie@noaa.gov), CVP and COM (Virginia.Selz@noaa.gov)
- ***Postdoctoral***
  - **Climate and Global Change Fellowship, Sept/Oct**
    - Observing, understanding, modeling, and predicting climate variability, change, and impacts on seasonal to longer time scales
  - Contacts: Kate Rodd (krodd@ucar.edu) or Cindy Bruyère (bruyerec@ucar.edu)
- ***Undergraduate***
  - **Hollings, Lapenta, EPP/MSI**
  - Contact: Todd.Christenson@noaa.gov

https://cpo.noaa.gov/Funding-Opportunities



https://cpaess.ucar.edu/cgc

NOAA Small Business Innovation Research (SBIR) Program, Technology Partnerships Office

- ***NOAA SBIR***
  - Investing NOAA research funds in **American small businesses**
  - Providing guidance to entrepreneurs throughout the process of researching, developing, and commercializing products or services.

- ***Timeline***
  - Opening Date: December
  - Letter of Intent Due: January
  - Closing Date: March

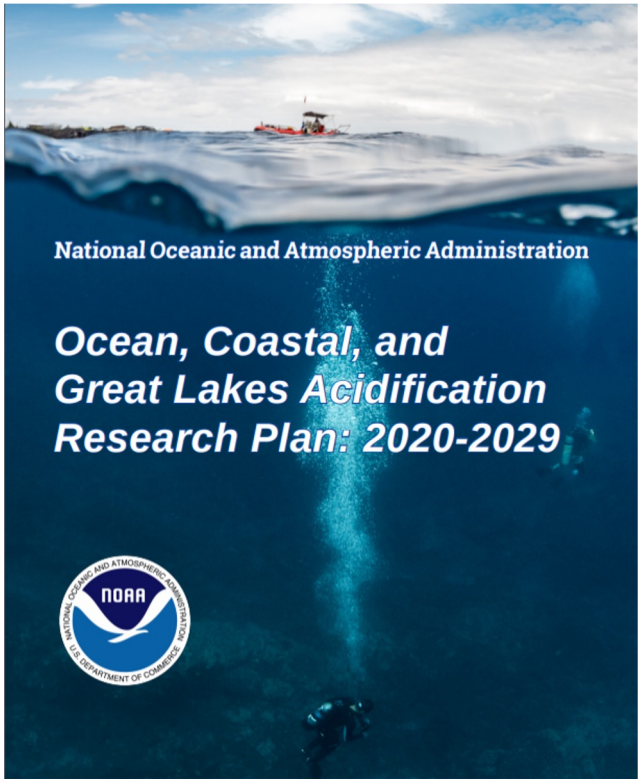
- ***Topics***
  - Extreme Events and Cascading Hazards
  - Coastal Resilience
  - The Changing Ocean
  - Water Availability, Quality, and Risk
  - Effects of Space Weather
  - Monitoring and Modeling for Climate Change Mitigation

https://techpartnerships.noaa.gov/sbir/fundingopportunities

- ***Examples***
  - Support monitoring of marine health including remote sensing and in-situ monitoring technologies, for regionally-optimized ocean ecosystem and biogeochemical observations
  - Support innovative observation and exploration of the ocean, including the deep ocean, and improved data assimilation into ocean models, to improve understanding and promote more effective management of ocean resources
  - Facilitate quantification of short- to long-term outlooks and projections of Arctic sea ice

NOAA Ocean Acidification Program (OAP)

Acting Director: Dwight Gledhill



1 Sustain and develop **time-series** that integrate carbonate chemistry and biological observations in critical habitats that improve high-resolution regional **models**;

MONITORING

2 Characterize **biological sensitivity** to direct and indirect impacts of ocean acidification

BIOLOGICAL RESPONSE

3 Improve the understanding of the **socieoconomic risk and vulnerability** of fishing and coastal communities to OA to **develop adaptation strategies**.

HUMAN CONNECTIONS

NOAA Ocean Acidification Program (OAP)

Acting Director: Dwight Gledhill

The National Oceanographic Partnership Program (NOPP) is designed to facilitate inter-agency cooperation and public-private partnerships.

In FY22, NOAA's NOPP and Ocean Acidification Program have co-sponsored an internal request for proposals (RFP) for marine CDR research with generous funding match from the ClimateWorks Foundation and guiding input from multiple federal partners.

In FY23, an inter-agency NOPP Notice of Funding Opportunity (NOFO) was released with support from NOAA, NSF, DOE, EPA, Navy, and ClimateWorks.

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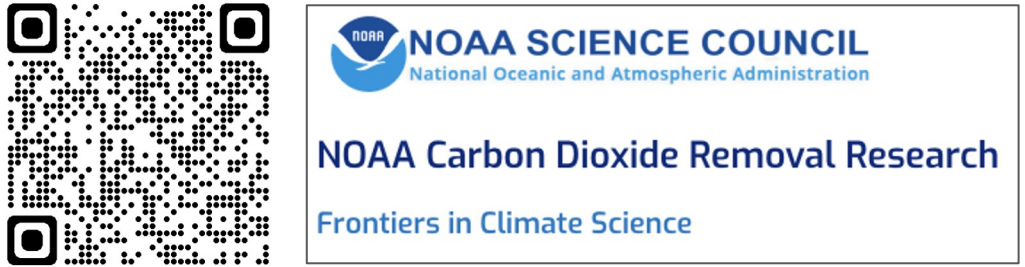
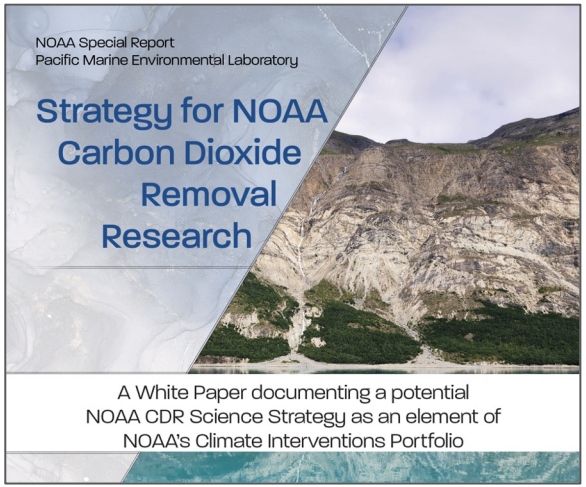
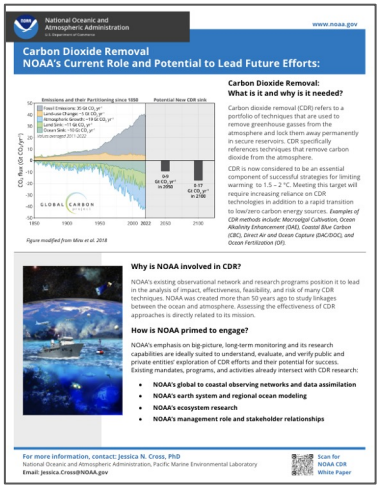
NOAA's final CDR Research Strategy, including outreach materials and a summary of public comments, was released last week and can be found on the NOAA Science Council Website.







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NATIONAL MARINE SANCTUARIES

The Office of National Marine Sanctuaries has also provided guidance for CDR in Sanctuary settings.

Table 1. Existing relevant regulations

Relevant Law, Agreement, or Regulation	Applicability	Impacted CDR Approaches
International		
U.N. Convention on the Law of the Sea (UNCLOS)[47]	Part XIII states a country's right to conduct peaceful, appropriate, and truly necessary marine scientific research within its EEZ and territorial waters. Article 193 in Part XII recognizes a country's sovereign rights to exploit natural resources in their jurisdiction, and CO_2 sequestration via mCDR may apply.	Ecosystem Recovery Coastal Blue Carbon Nutrient Fertilization Alkalinity Enhancement Seaweed Cultivation Artificial Upwelling and Downwelling Electrochemical Methods Geologic Storage
UNCLOS's Straddling Fish Stock Agreement (UNFA)[48]	Parties are required to minimize pollution and its potential impacts. Carbon dioxide has the potential to fall under the definition of pollution and affect the deployment of various mCDR activities. The agreement emphasizes avoiding transforming one type of pollution into another.	Nutrient Fertilization Alkalinity Enhancement Geologic Storage
United Nations Framework Convention on Climate Change,[49] Kyoto Protocol,[50] Paris Agreement[51]	Implicitly supports Carbon Dioxide Removal approaches to reduce atmospheric CO_2 as a means to mitigate climate change	Ecosystem Recovery Coastal Blue Carbon Nutrient Fertilization Alkalinity Enhancement Seaweed Cultivation Artificial Upwelling and Downwelling

[47] United Nations Convention on the Law of the Sea, Montego Bay, 10 December 1982, *United Nations Treaty Collection*. https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXI-6&chapter=21&Temp=mtdsg3&clang=_en.

[48] Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea Of 10 December 1982 Relating to the Conservation And Management Of Straddling Fish Stocks And Highly Migratory Fish Stocks, New York, 8 September 1995, A/CONF.164/37. https://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm.

[49] United Nations Framework Convention on Climate Change, New York, 9 May 1992, United Nations Treaty Collection. https://treaties.un.org/pages/ViewDetailsIII.aspx?src=TREATY&mtdsg_no=XXVII-7&chapter=27&Temp=mtdsg3&clang=_en.

[50] Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 10 December 1997, FCCC/CP/1997/L.7/Add.1. https://unfccc.int/sites/default/files/resource/docs/cop3/l07a01.pdf.

[51] Paris Agreement, Paris, 2015. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

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Thank you!

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https://oceanacidification.noaa.gov/

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