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Science User Group for Research (SUGR) Meeting:
Advancing Ocean Carbon Science

Introduction

George Voulgaris, Jim Edson & Amber Coogan

2024 Fall AGU Meeting

November 8, 2024

BGC Manual

Frontier's Paper

Objectives of SUGR Meetings

Exchange of Ideas

SUGR meetings facilitate direct feedback from the community to improve OOI services. This collaborative approach ensures that OOI remains responsive to user needs.

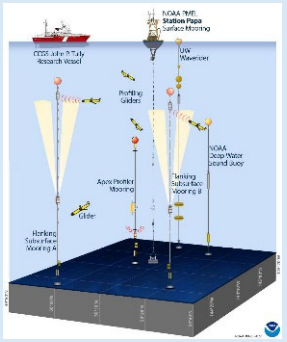
Informal Mentorship

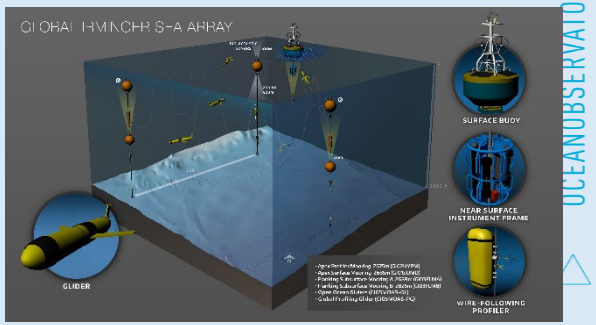
These gatherings foster connections between senior and Early-Career Scientists (ECS). This mentorship model promotes knowledge transfer and career development within the OOI community.

NSF's Ocean Observatories Initiative

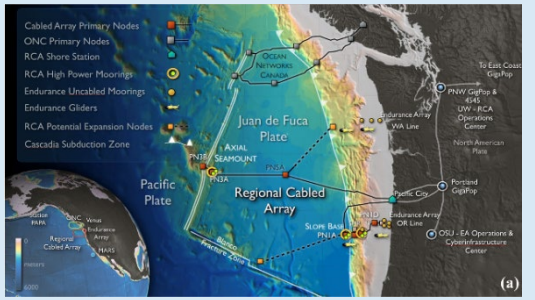
A System of Systems

PMEL

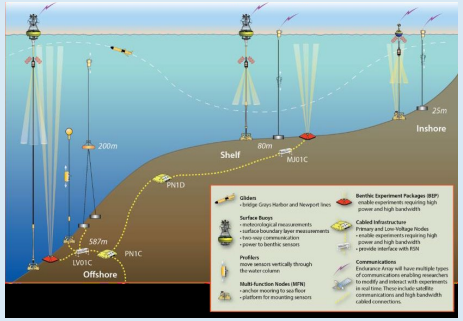




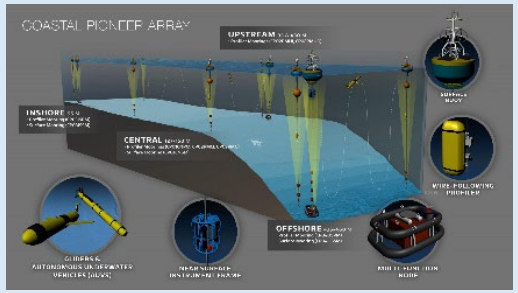
Global Station Papa and Irminger Arrays



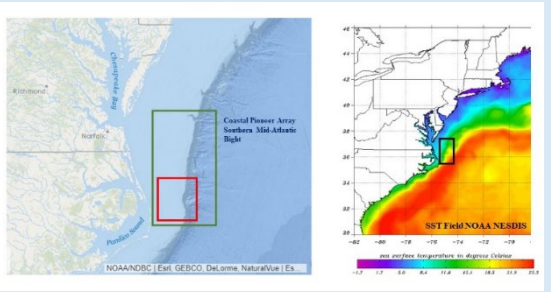
Regional Cabled Array



Coastal Endurance Array



Coastal Pioneer Arrays at NES



Coastal Pioneer Arrays at MAB

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Opportunities for Observatory-Based Research

Sustained arrays supporting sophisticated sensors in challenging locations.

From seafloor to lower atmosphere.

Open access to interdisciplinary data.

Answers to data access questions.

Long-term time series data sets and visualization tools.

- Opportunities for shared ship time.
- Feasibility assessment for external PI proposals.
- Assistance with PI-added sensors and platforms.
- Community engagement activities.

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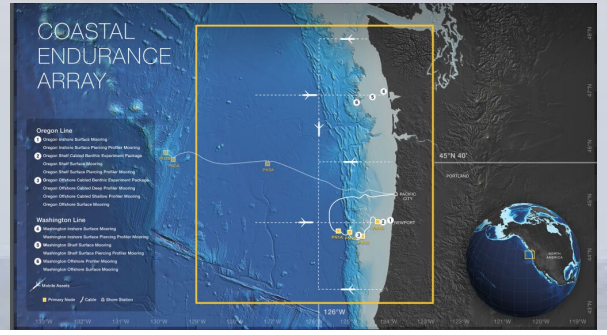
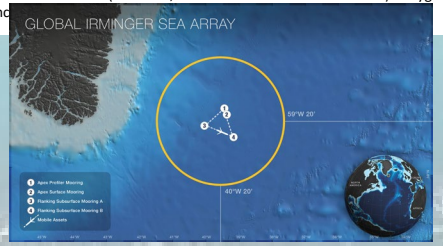
Biogeochemical Sensor Data from the NSF OOI Arrays

Adapted from Palevsky et al., 2022. OOI Biogeochemical Sensor Data: Best Practices & User Guide

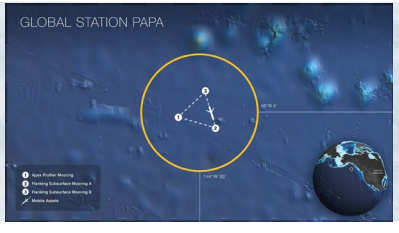
http://dx.doi.org/10.25607/OBP-1865



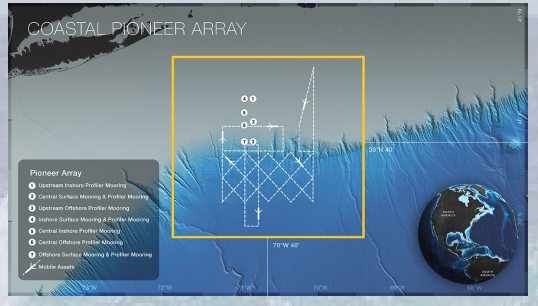
Schematic drawing of the OOI Coastal Endurance Array. All platforms include BGC sensors:
Inshore Surface Moorings (1, 4): Surface Buoy - Fluorescence/Chlorophyll; Near-surface instrument frame (NSIF) at 7 m - pCO_2, pH, Oxygen, Fluorescence/Chlorophyll, Nitrate; Multi-function node (MFN) at the bottom - pH, pCO_2, Oxygen.
Coastal Surface Moorings (2, 3, 5, 6): Surface Buoy - pCO_2; Near-surface instrument frame (NSIF) at 7 m - pH, Oxygen, Fluorescence/Chlorophyll, Nitrate; Washington Line (5, 6) Multi-function node (MFN) at the bottom or Oregon Line (2, 3) co-located Cabled Benthic Experiment Package - pH, pCO_2, Oxygen
Coastal Surface-Piercing Profiler Moorings (1, 2, 4, 5): Oxygen, Fluorescence/Chlorophyll, Nitrate (surface to bottom).
RCA Cabled Profiler Moorings (3): Shallow Profiler Winched Pod (5 to 200 m) - pCO_2, pH, Oxygen, Nitrate, Fluorescence/Chlorophyll; Fixed Platform at 200 m - pH, pCO_2, Oxygen, Zooplankton; Deep Profiler (125 to 580 m) - Oxygen, Fluorescence/Chlorophyll;
RCA Seafloor Benthic Experiment Platforms: (2,3) pCO_2, pH, Oxygen, Camera, Hydrophone, Zooplankton (2).
Wire-Following Profiler Mooring (6) - Oxygen, Fluorescence/Chlorophyll (15 to 540 m)
Mobile Assets: Coastal Gliders (0 - 200 m, 0 - 1000 m or 10 m above bottom) - Oxygen and Fluorescenc



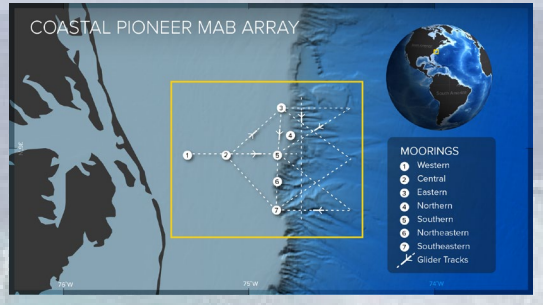
Schematic drawing of the OOI Global Irminger Sea Array. Also applicable to the Argentine Basin Array (active 2015-2018) and Southern Ocean Array (active 2015-2020). All platforms include BGC sensors:
1. Apex Profiler Mooring: Oxygen and Fluorescence/ Chlorophyll-a on the shallow (≈150-2100m/2600 m at Irminger) and deep (2150-4100m, not at Irminger) ≈ profilers.
2. Apex Surface Mooring: pCO_2 and Oxygen at surface, 12, 40, 80, 130 m; pH at 20 & 100 m; Fluorescence/ Chlorophyll and Nitrate at surface & 12 m.
3. & 4 Flanking Moorings A & B: Oxygen, Fluorescence/ Chlorophyll, and pH at 30 m.
4. Mobile Assets: Oxygen and Fluorescence/Chlorophyll on Open Ocean Gliders (0-1000 m); Oxygen, Fluorescence/ Chlorophyll, and Nitrate on Global Profiling Gliders (0-200 m).



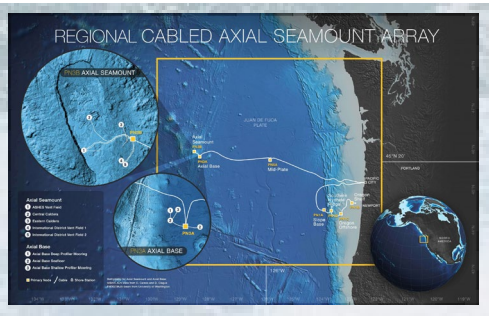
Schematic drawing of the OOI Global Station Papa Array. All platforms include BGC sensors:
1. Apex Profiler Mooring: Oxygen and Fluorescence/Chlorophyll-a on shallow (≈150-2100m) and deep (2150-4100m) profilers.
2. and 3. Flanking Moorings A & B: Oxygen, Fluorescence/Chlorophyll-a, and pH at 30 m.
4. Mobile Assets: Oxygen and Fluorescence/Chlorophyll-a on Open Ocean Gliders (0-1000 m); Oxygen, Fluorescence/Chlorophyll-a, and Nitrate on Global Profiling Gliders (0-200 m).



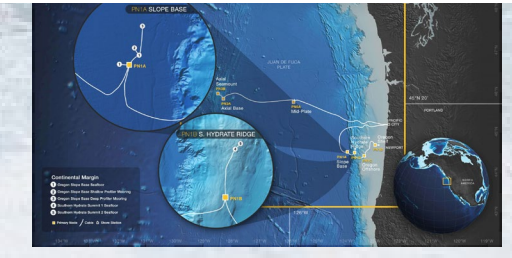
Schematic drawing of the OOI Coastal Pioneer New England Shelf (NES) Array*. All platforms include BGC sensors:
Inshore (1), Central (2), & Offshore (3) Surface Moorings: Surface buoy - pCO_2; Near-surface instrument frame (NSIF) at 7 m - pH, Oxygen, Fluorescence/Chlorophyll, Nitrate; Multi-function node (MFN) at the bottom - pH, pCO_2, Oxygen , Zooplankton.
Inshore (4), Central Inshore (5), Central Offshore (6), & Offshore (7) Profiler Moorings: Oxygen and Fluorescence/Chlorophyll (25 m depth to 20 m above bottom).
Mobile Assets: Coastal Gliders (0 - 200 m, 0 - 1000 m or 10 m above bottom) - Oxygen and Fluorescence/ Chlorophyll; Coastal Profiling Gliders (0 - 200 m or 10 m above bottom) and AUVs - Oxygen, Fluorescence/Chlorophyll, Nitrate.
*NES location, deployed 2016-2022; the Coastal Pioneer Array will move to the Southern MAB with a new array configuration beginning in 2024.



Schematic drawing of the OOI Coastal Pioneer Mid-Atlantic Bight (MAB) Array. All platforms include BGC sensors:
Western (1) and Central (2) Shallow Water Moorings: Profiler – Oxygen and Chlorophyll
fluorescence (3 m depth to 6 m above bottom).
Central (2), Northern (3) and Southern (7) Surface Moorings: Surface buoy - pCO2; Near
Surface Instrument frame (NSIF) at 7 m – pH, Oxygen, Chlorophyll fluorescence, Nitrate; Multi-Function Node (MFN) 1 m above seafloor – pH, pCO2, Oxygen, Zooplankton.
Central (2) Surface Mooring: NSIF – Imaging Flow CytoBot.
Northern (3), Northeast (4), Eastern (5), Southeast (6) and Southern (7) Profiler Moorings – Oxygen and Chlorophyll fluorescence (25 m depth to 20 m above bottom).
Coastal Gliders (dashed lines): All gliders – Oxygen and Chlorophyll fluorescence; Offshore Flux line – Nitrate. AUVs (not shown): Oxygen, Chlorophyll fluorescence
and Nitrate.



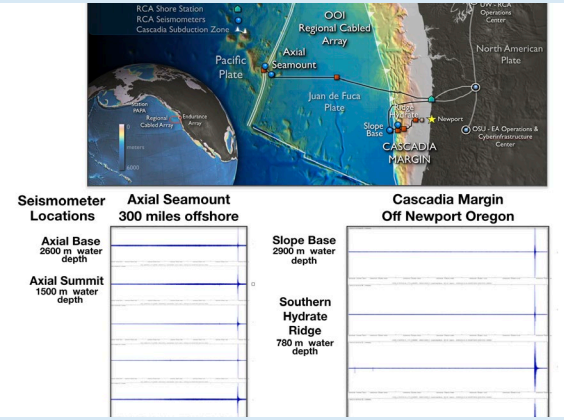
Schematic drawing of the OOI Regional Cabled Axial Seamount Array. Axial Base and Caldera host the following BGC sensors, including:
Axial Base Deep Profiler Mooring: Oxygen, Fluorescence/Chlorophyll (125 to 2,465 m)
Axial Base Seafloor: Oxygen
Axial Base Shallow Profiler Mooring: Winched Profiler Pod: pCO_2, pH, Oxygen,
Fluorescence/ Chlorophyll, Nitrate (5 to 200 m); Fixed Platform at 200 m - pH, Oxygen, Fluorescence/ Chlorophyll
Axial Caldera: Live HD Camera (1) (1500 m); Fluid chemistry, microbial DNA (4).

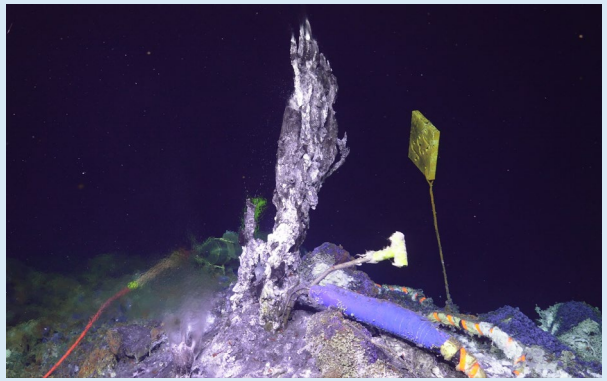


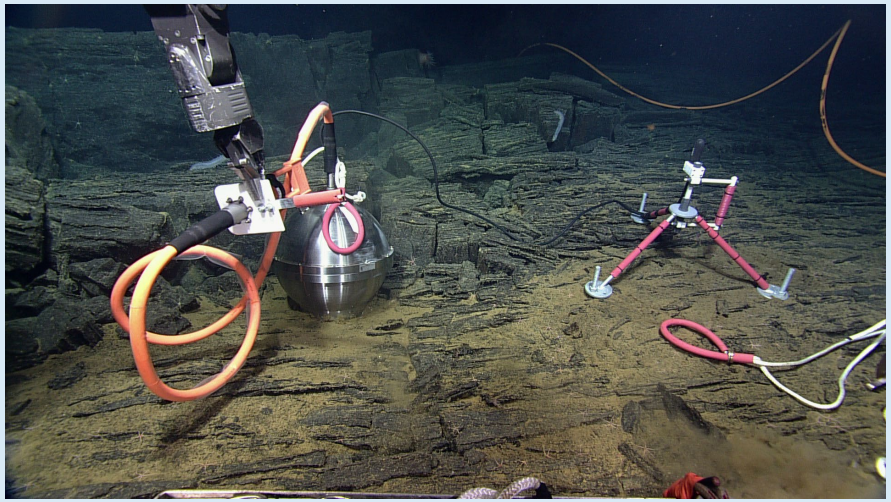
Schematic drawing of the OOI Regional Cabled Continental Margin Array:
Oregon Slope Base Seafloor: Oxygen
Oregon Slope Base Shallow Profiler Mooring: Shallow Profiler Winched Pod
pCO_2, pH, Oxygen, Fluorescence/Chlorophyll, Nitrate (5 to 200 m); Fixed
Platform at 200 m - pH, Oxygen, Fluorescence/Chlorophyll
Oregon Slope Base Deep Profiler Mooring: Oxygen, Fluorescence/Chlorophyll
(125 to 2,905 m).

Democratization of Data

*The OOI provides research quality data to the user community. These data are **open access** to researchers, educators, and the public in near real-time at: https://oceanobservatories.org/*







Geophysical & Environmental Variables

Seafloor

- Seafloor Pressure
- Temperature (0->350°C)
- Bottom Pressure-Tilt
- Seismometers – short period & broadband
- Accelerometer
- Hydrophones low frequency and broadband
- Remote Access Fluid Sampler (Major-Gas)
- Temperature – Resistivity
- Imagery (Still & HD)
- HPIES
- Osmotic Fluid Samplers
- 3D Thermistor Array
- Fluid Flow Meters
- Horizontal Electrometer Pressure-Inverted Echosounder
- Mammal Vocalization
- Microbial DNA

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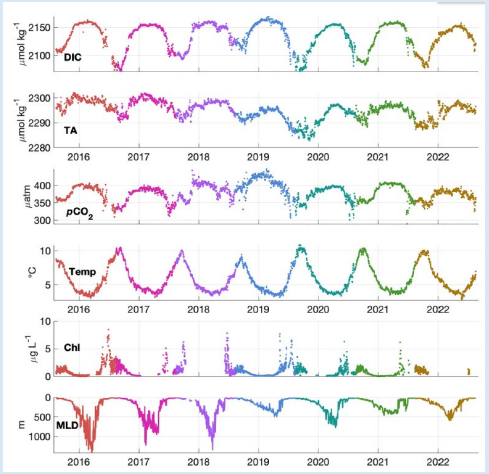

Yoder, M. F., Palevsky, H. I., & Fogaren, K. E. (2024). Net community production and inorganic carbon cycling in the central Irminger Sea. J. Geophys. Res., 129, e2024JC021027. https://doi.org/10.1029/2024JC021027

SUGR meeting at the Fall AGU meeting Advancing Ocean Carbon Science Sunday December 8th from 11am to 2pm.

Palevsky, H. and 23 co-authors, (2023). OOI Biogeochemical Sensor Data: Best Practices & User Guide Global Ocean Observing System, 1(1.1), 1–135. https://doi.org/10.25607/OBP-1865.2 **GOOS ENDORSED PRACTICE**

ECV Collected

Surface Variables

- Pressure
- Radiative Fluxes
- Temperature
- Humidity
- Precipitation
- Moisture/Evaporation
- Vector Wind
- DC Stress & Buoyancy Flux

Oceanographic

- Net Surface Heat Flux
- Temperature Profiles
- Salinity Profiles
- Currents Profiles
- Sea Level
- Sound
- Turbidity

Biogeochemical Sensors (at multiple depths)

- pH
- pCO_2
- Oxygen
- Plankton & zooplankton
- Nitrate
- Chlorophyll-*a*
- CDOM
- Ship Surveys (DIC, TA)

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Opportunities for Observatory-Based Research

Agenda

1. Intro
2. OOI talk on BGS measurements
3. Lightning Talks from students
4. A research example using the OOI BGC data on the Irminger Sea
5. BGC working group and the BGC manual
6. New and updated BGC sensors and platforms
7. NOAA contributions
8. Discussion

Frontier's Paper

BGC Manual

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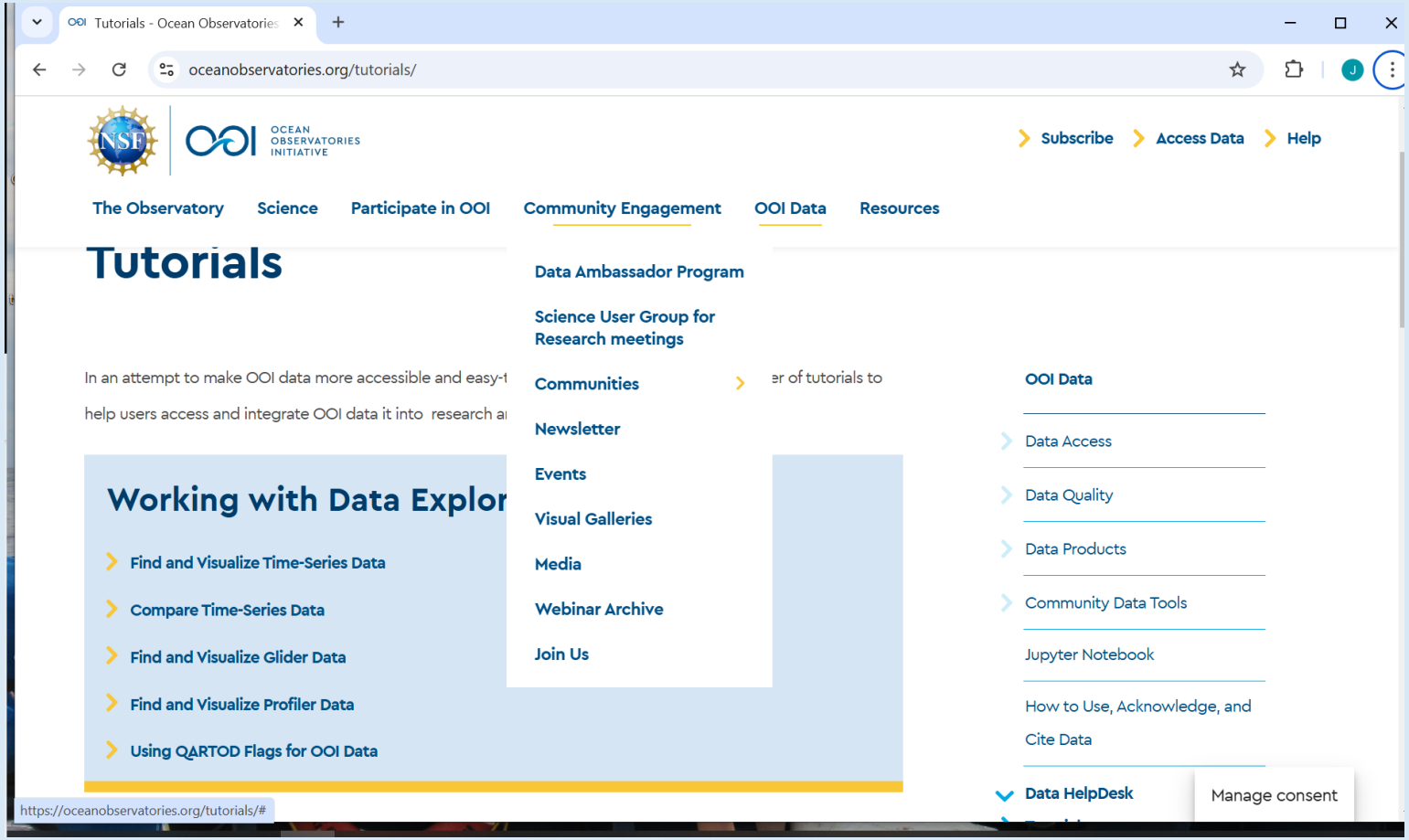
Data Explorer Tutorials

oceanobservatories.org/tutorials/



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