

# The OOI Data Lab Manual: Using large ocean observatory data to improve data literacy in multi-modal undergraduate courses

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## Why teach with ocean observing data?

Large real-world datasets used in professional oceanography require advanced data literacy skills.

Undergraduate curriculum, especially at the introductory level, traditionally focuses on idealized graphical models and simplified data.

Students need opportunities for guided practice with authentic, “messy” data.

## What do undergraduate faculty need?

Faculty that teach introductory oceanography courses are more likely to incorporate large oceanographic data when they have

- Time and tools to explore raw data (rare!)
- Curated datasets linked to course learning objectives
- Structured, interactive lesson plans
- Professional development and peer examples

## Development of the OOI Data Lab Manual

Nine educators convened in January 2020, supported by the Ocean Data Labs team, to develop a structured collection of data-rich exercises with curated data from the Ocean Observatories Initiative (OOI), tailored for introductory oceanography courses.

20 instructors tested labs in Fall 2020 and authors revised the exercises based on reviews. 20 additional instructors tested the revised exercises.

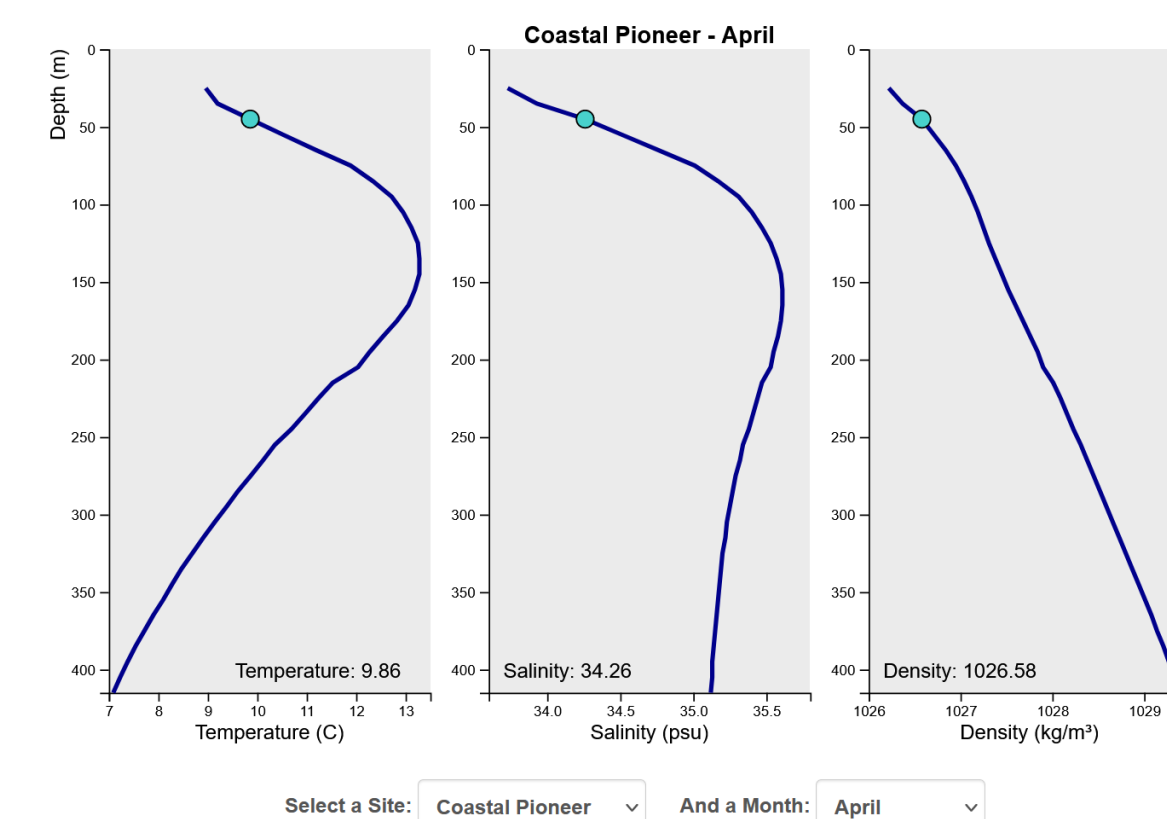
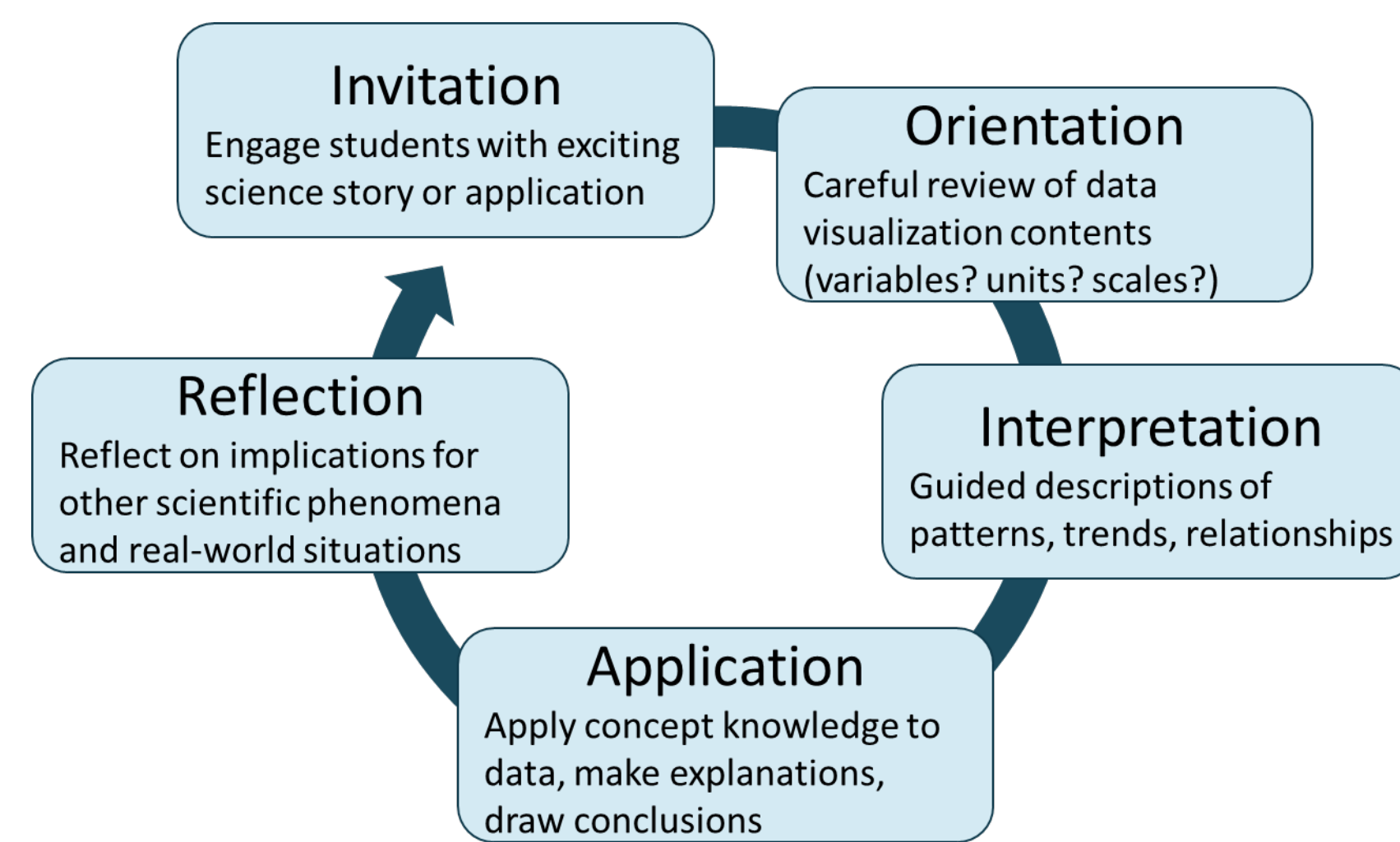
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*Citation:* Bristol, D.L. and Pfeiffer-Herbert, A. (Eds.). 2021. *Ocean Data Labs: Exploring the Ocean with OOI Data – Online Laboratory Manual*. 2nd edition. Rutgers, The State University of New Jersey.

*Acknowledgements:* The Ocean Data Labs Project and continuing lab manual development supported by NSF grants #OCE-1831625 and #OCE-2316076. Instructor surveys conducted by the Science Education Resource Center at Carleton College.

## OOI Data Lab Manual overview



Drag the depth ranges into the correct boxes

The depth scale for the two locations is different. Match the correct depth scale to the correct location. (And, keep the difference in scale in mind when comparing the two locations.)

Coastal Pioneer: 0-400 m

Global Argentine: 0-2500 m

Check

Dozens of quick check questions provide immediate feedback



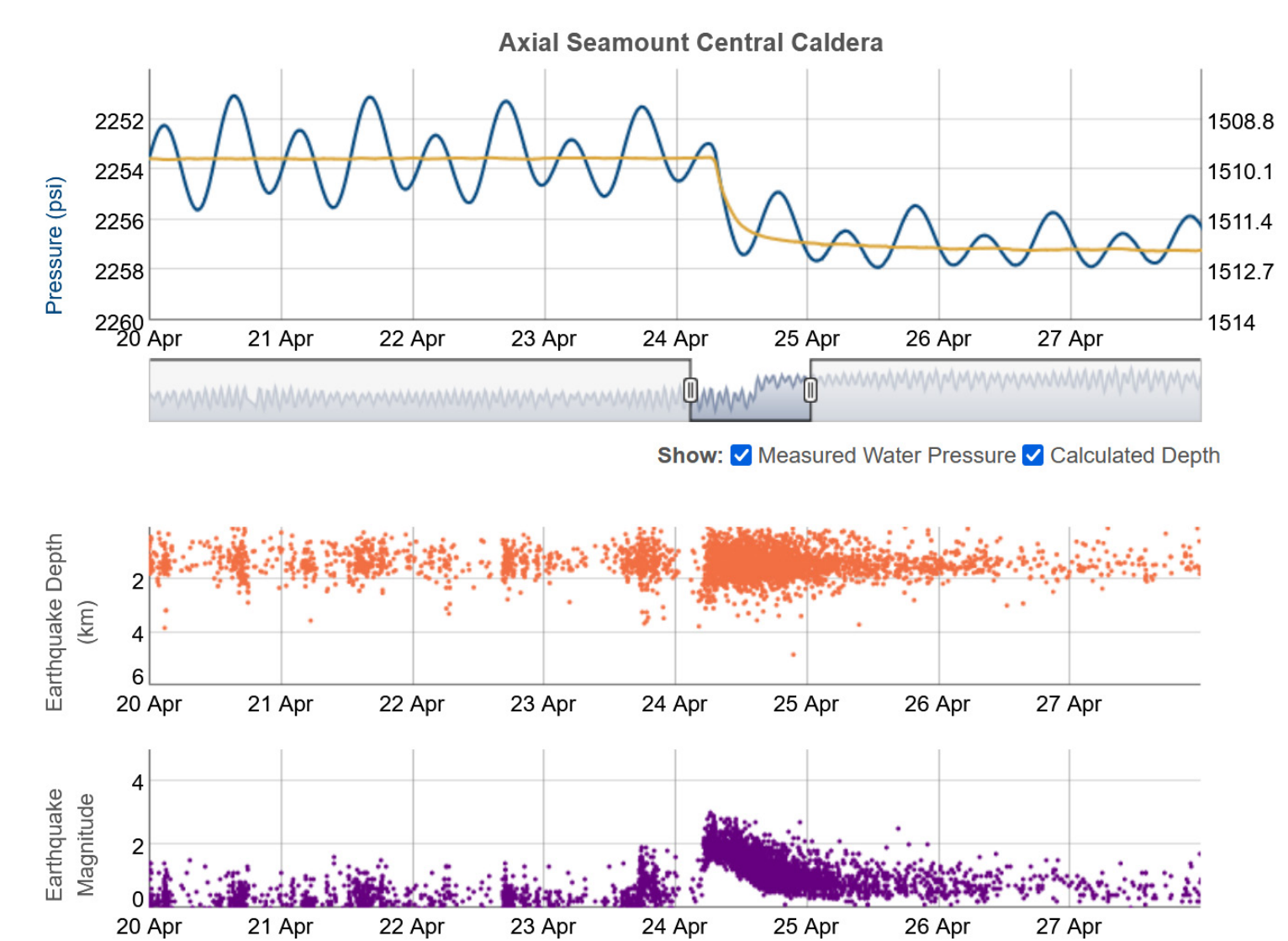
Scan for online table of contents

**Table 1.** List of online lab chapters with flexible activities that connect to common introductory oceanography topics and develop targeted data literacy skills.

Lab chapter	Oceanography topics	Data skills
Lab 1: Introduction to the OOI – the Collection of Oceanographic Data	marine technology	Latitude and longitude coordinates
Lab 2: Building Data Skills – the Display of Oceanographic Data	common oceanographic graph types	graph orientation and interpretation
Lab 3: Plate Tectonics and the Seafloor	seafloor features, tectonic plate boundaries, earthquakes	Bathymetric charts, bubble charts
Lab 4: Sea Floor Changes in a Volcanically Active Setting	water pressure, volcanism, earthquakes	Bathymetric charts, time series graphs
Lab 5: Investigating Density and Stratification in the Ocean	factors affecting seawater density, density stratification	Vertical profile graphs
Lab 6: Waves Generated by Large Storms	barometric pressure, wind, waves	Time series minima and maxima, calculate speeds
Lab 7: Identify Factors that Control Primary Production	primary productivity, density stratification, seasonal cycles	Visual correlation of time series
Lab 8: Anoxic Events – Solve the Mystery of the Dying Crabs	coastal upwelling, hypoxia	Time series correlation, vertical section graphs

Lab chapters follow a **scaffolded learning cycle** to reinforce data literacy and oceanographic concepts

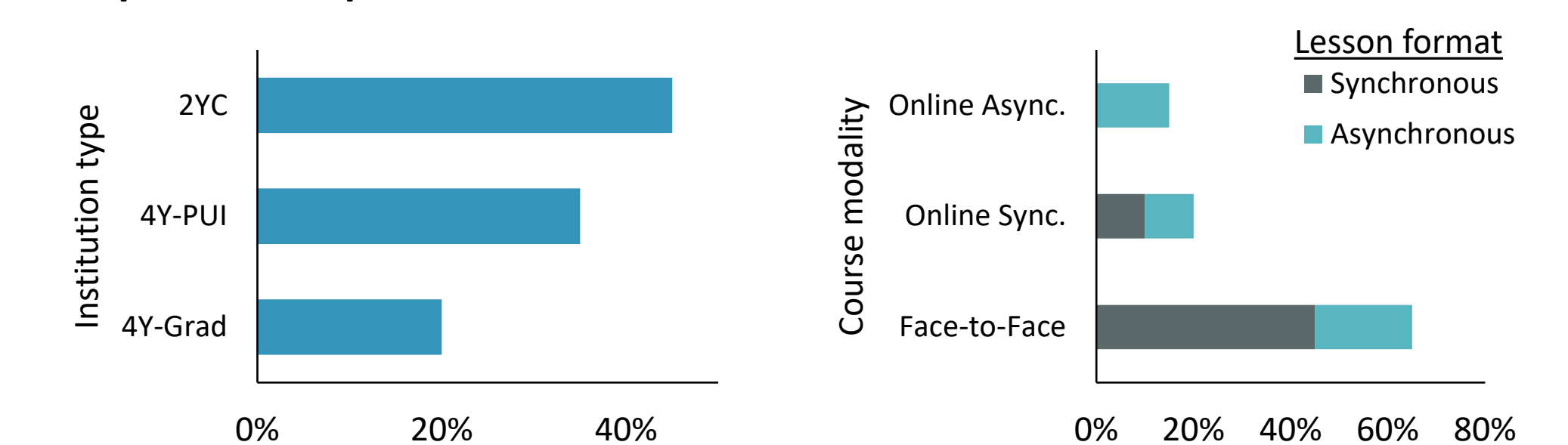
**29 interactive data visualizations** allow students to select, zoom and hover to read data values



**Open-ended questions** prompt application and reflection through a classroom discussion or assignment

## Feedback from pilot testers

20 instructors provided detailed feedback on the revised lab exercises in Fall 2021 of which 85% had no prior experience with OOI Data Labs.



Pilot testers implemented labs in class sizes from 7-40 students at a range of institution types (left; 2YC = two-year, community or technical college, 4Y-PUI = primarily undergraduate four-year college; 4Y-Grad = university offering significant graduate education. Course modalities (right) included face-to-face courses on campus, online synchronous and online asynchronous courses. Within these courses, instructors selected synchronous (gray) or asynchronous (teal) delivery.

Instructors noted that the interactive visualizations and guided questions engaged students in the process of making meaning from authentic data

This was the first time that some of my students saw and worked with real-life data

I wanted the students to be able to look at real-life data and understand that sometimes data is messy, but we can still find trends

I think the greatest benefit was for the students in my class who struggled with quantitative concepts – this was a major confidence booster

My students have become more comfortable with interpreting data from plots

### Teaching tips from pilot testers

- Gauge the material in relation to your course and adjust the level of detail to fit your students' needs.
- Read the instructor guide!
- Introduce key concepts before the activity
- You may need more class time than you expect
- Check in with students frequently. If asynchronous, supplement with video tutorials.

## Next steps and an invitation

Upcoming revisions of the Data Lab Manual will

- Assess and fill curricular gaps
- Develop activities related to the relocation of the Pioneer Array to the southern Mid-Atlantic Bight
- Add guided Python notebook exercises

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