**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.

**Contributing authors** (in alphabetical order):


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

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

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**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.

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

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**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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