

Connecting Climate Phenomena and Accessible Data:

ENSO Analysis with OOI, ONC, and NEON Infrastructure

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Project Scope

Main Objective:

Retrieving comparable environmental data from scientific infrastructures (OOI, ONC, NEON, NOAA).

Secondary Objective:

Assess access retrieval and have them plotted in a graph with ENSO overlays with Python on JupyterHUB.

Ensure detailed documentation for future use.



El Niño-Southern Oscillation (ENSO)

“Why compare data?”

ENSO's global impact:

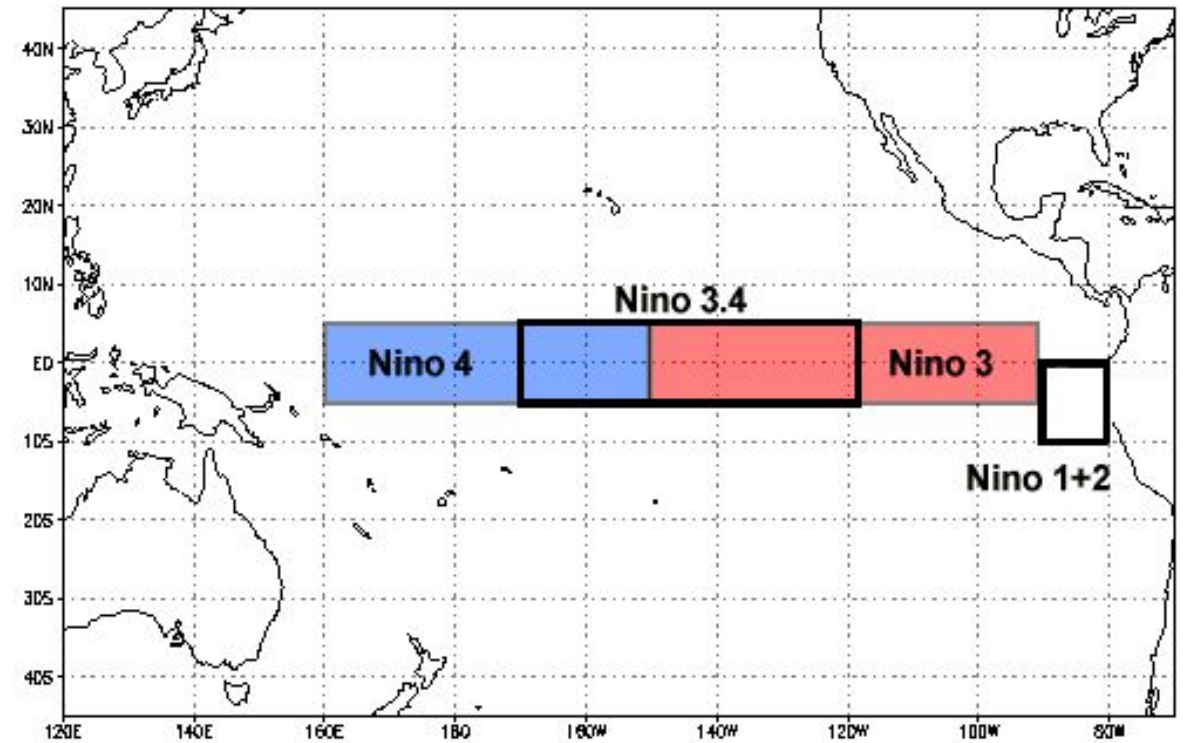
- El Niño and La Niña affect ocean currents, marine ecosystems, and even weather patterns thousands of miles away.

Multiple data sources:

- Each network captures the ocean in its own way different depths, sensors, and sampling rates.

The role of cyberinfrastructure:

- How data shared directly impacts the clarity of climate signals in our graphs.
 - *Granularity* (the detail in time, depth, and location) can make the difference.
- A single dataset might miss certain patterns that another captures more clearly



Niño Regions taken from <https://www.ncei.noaa.gov/access/monitoring/enso/sst/>

Methodology

Retrieve Data

- Explore possible sites and find datasets (csv, netCDF files)
- Pull OOI Data via Jupyter HUB or THREDDS.
- Retrieve ONC data via ERDDAP or file downloads
- Access NEON air and fresh water temperature through Data API

Clean & Filter

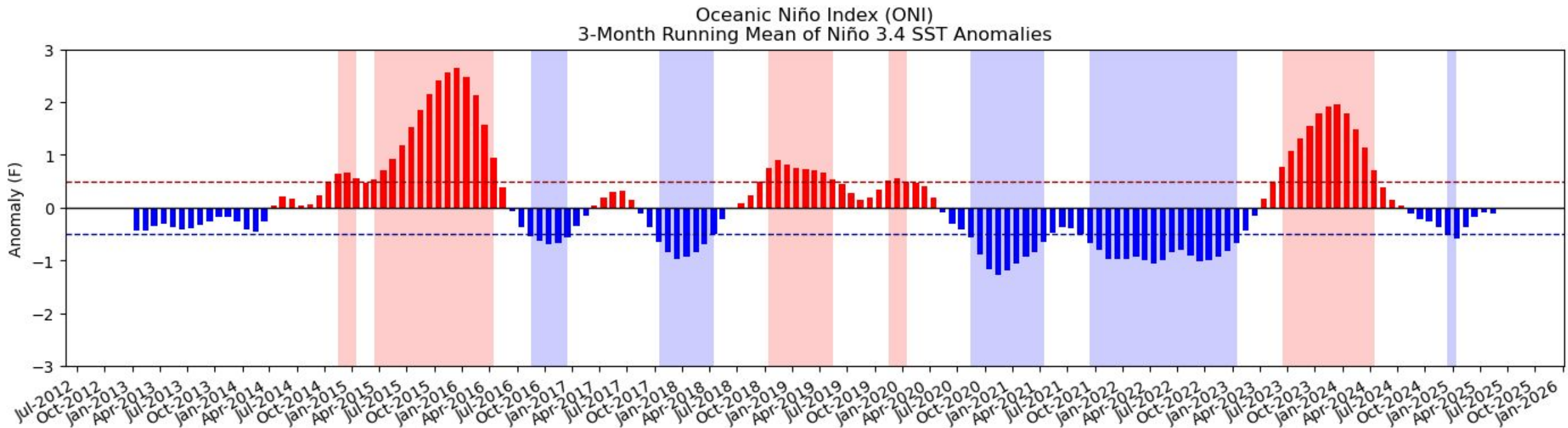
- Convert timestamps to a common format
- Resample to monthly means for comparability



Plot

- Generate temperature trends
- Overlay ONI-based ENSO phases (El Niño and La Niña)
- Prepare figures for comparison.
- Document steps and challenges that occur during the process.

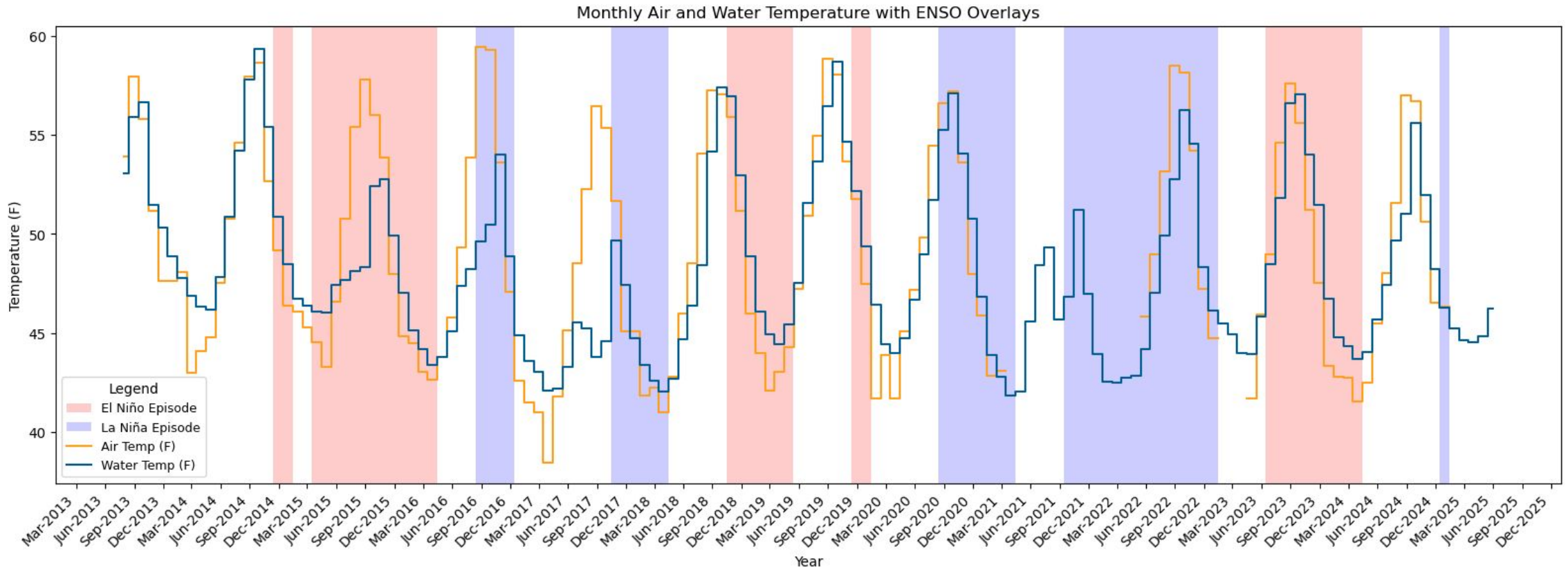
Graph Comparison



A graph of ONI made through Python's library, Matplotlib.

Data Source: <https://www.cpc.ncep.noaa.gov/data/indices/oni.ascii.txt>

Graph Comparison



Data Source: Ocean Observatory Initiative

Time Range: 2013-07 to 2025-05

Median Depth: 88.9 m

ENSO Classification: NOAA ONI Index: <https://www.ncei.noaa.gov/access/monitoring/enso/sst/>

Reference: Sea Water Temperature: #

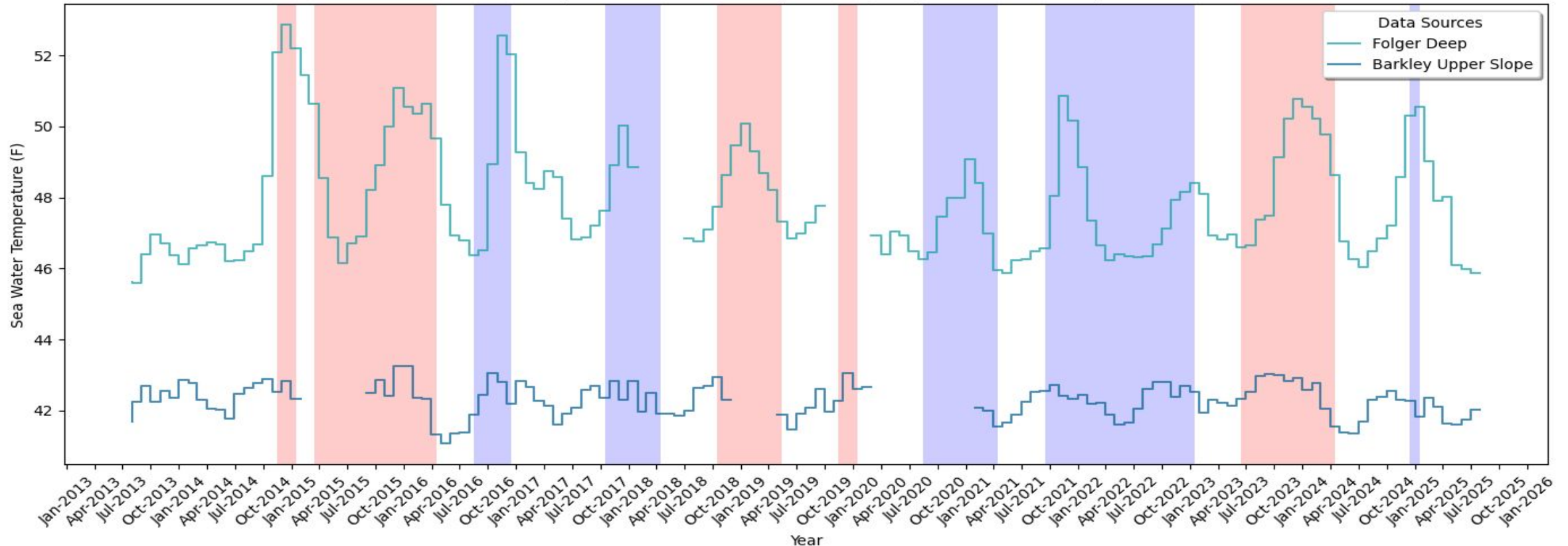
https://thredds.dataexplorer.oceanobservatories.org/thredds/catalog/ooigoldcopy/public/GP03FLMB-RIM01-02-CTDMOG060-recovered_inst-ctdmo_ghqr_instrument_recovered/catalog.html

& Air Temperature <https://www.pmel.noaa.gov/ocs/data/disdel/>



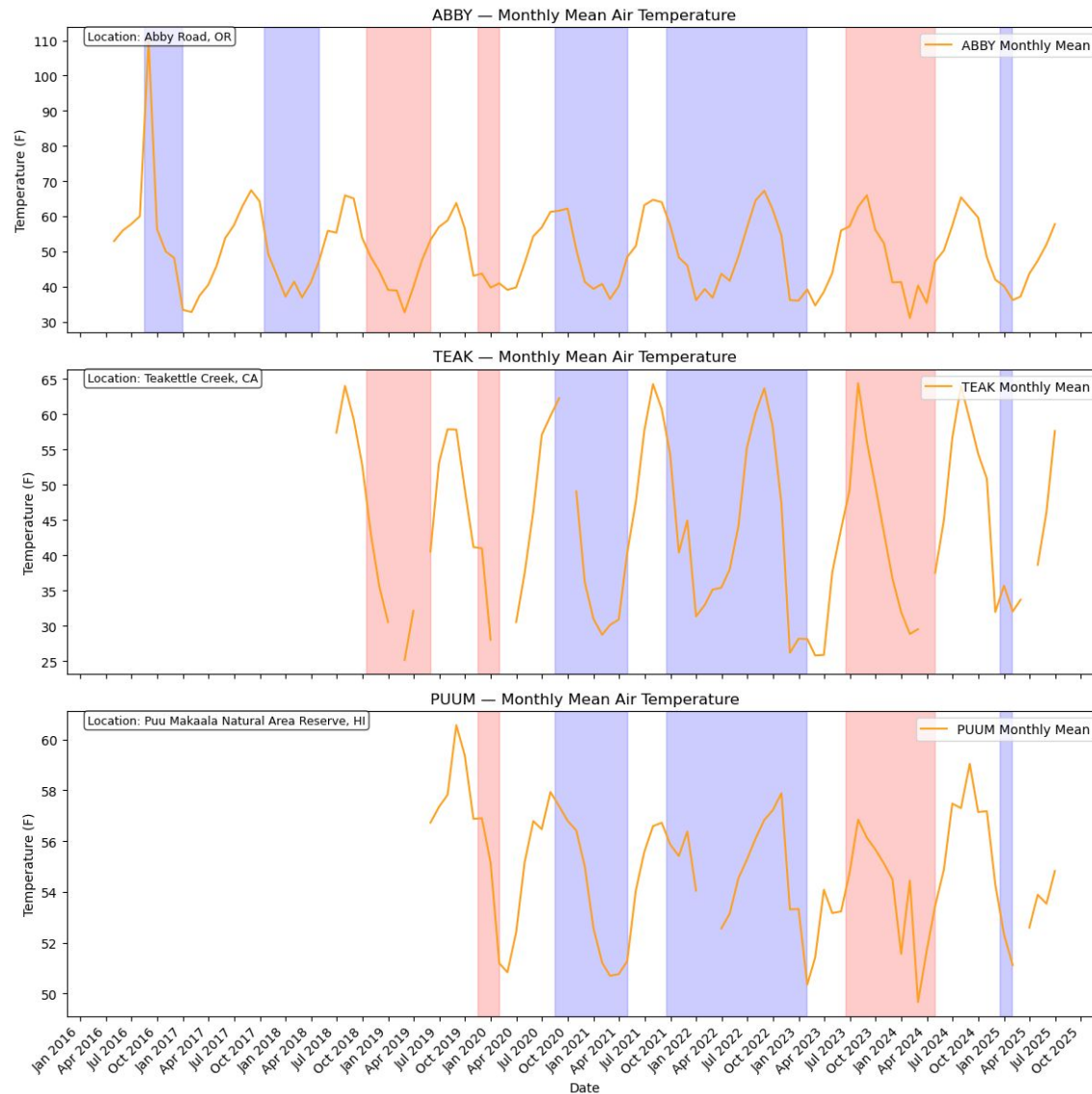
Graph Comparison

Monthly Mean Sea Water Temperature (ONC) with ENSO Overlays

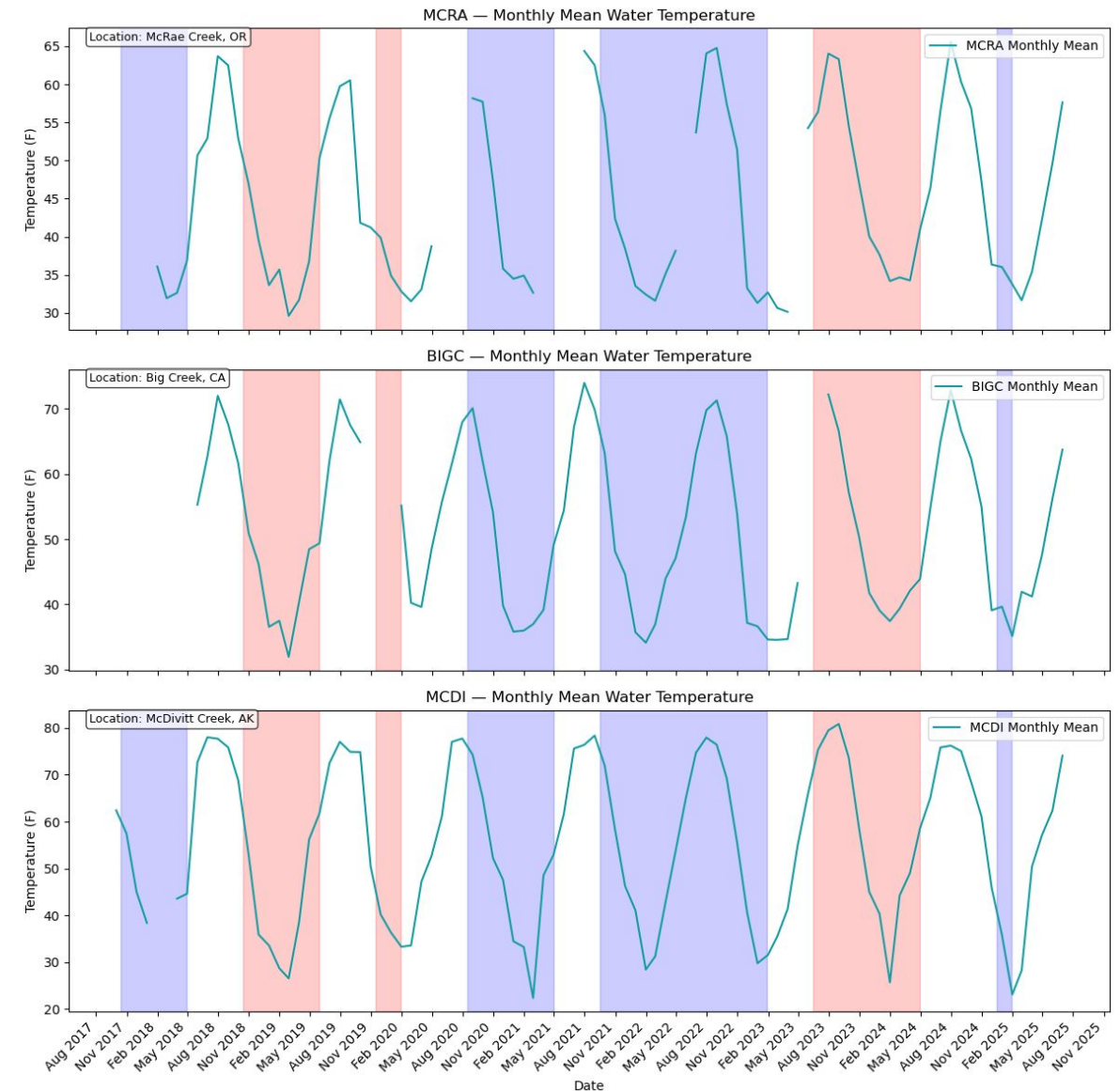


Note:

- ENSO periods shaded: Red = El Niño, Blue = La Niña (based on NOAA ONI Index).
- Folger Deep Median Depth: 87.56 meters
- Barkley Upper Slope Median Depth: 393 meters
- Daily resampled sea water temperature, converted to F, from 2013 to 2025.
- Data from Ocean Networks Canada (ONC).



NEON (National Ecological Observatory Network). Single aspirated air temperature (DP1.00002.001), RELEASE-2025.
<https://doi.org/10.48443/hejx-aa82>. Dataset accessed from
<https://data.neonscience.org/data-products/DP1.00002.001/RELEASE-2025> on August 2, 2025.



NEON (National Ecological Observatory Network). Temperature (PRT) in surface water (DP1.20053.001), RELEASE-2025. <https://doi.org/10.48443/0cm0-gh54>. Dataset accessed from
<https://data.neonscience.org/data-products/DP1.20053.001/RELEASE-2025> on August 4, 2025.

Analysis & Significance

ENSO Insights:

Overlays show temperature anomalies matching ONI ENSO periods

Higher-latitude sites (e.g., PAPA) show weaker short-term ENSO, clearer long-term cycles

Depth and resolution affect ENSO visibility in graphs

Infrastructure Design Impacts:

Accessibility differences:

- OOI's Hub/THREDDS
 - relatively streamlined retrieval
- ONC ERDDAP
 - high-resolution but fragmented access
- NEON API
 - consistent formatting, limited direct comparability for ocean sites

Challenges and Lessons

Technical & Analytical Challenges:

Missing metadata from csv files.

API quirks: slicing limits, throttling

Interpreting difference caused by infrastructure, not just the environment.

Future Steps:

Incorporate additional climate indices (e.g., PDO, NPGO) for broader context

Key Lessons:

Granularity is a research design decision.

Documentation is as important as data retrieval.

Data literacy must include infrastructure literacy.

Future Steps:

Expand analysis to more sites for better spatial coverage

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