

Final Presentation:

Ocean Air and Water

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Overview **FP-Ocean-Air-Temperature**

Problem Statement:

How do ocean and wave temperatures correlate near certain buoy locations?

What anomalies exist, and how do they correlate with climate events such as El Niño?

Datasets:

NOAA Water Temperature (2016-2024)

https://www.ndbc.noaa.gov/station_history.php?station=kwhh1

NOAA Air Temperature (2016-2024)

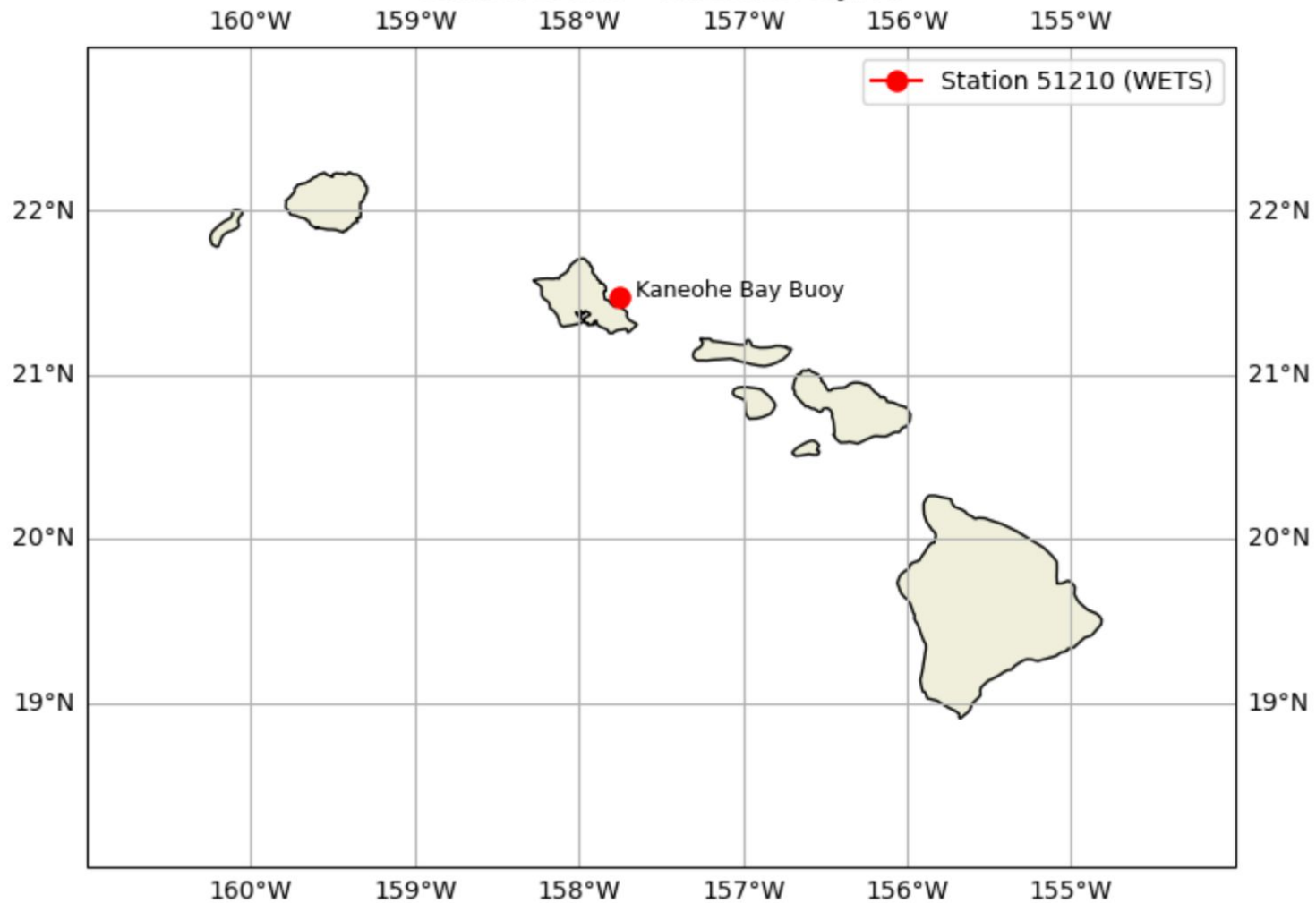
https://www.ndbc.noaa.gov/station_history.php?station=51210

Methodology/Packages

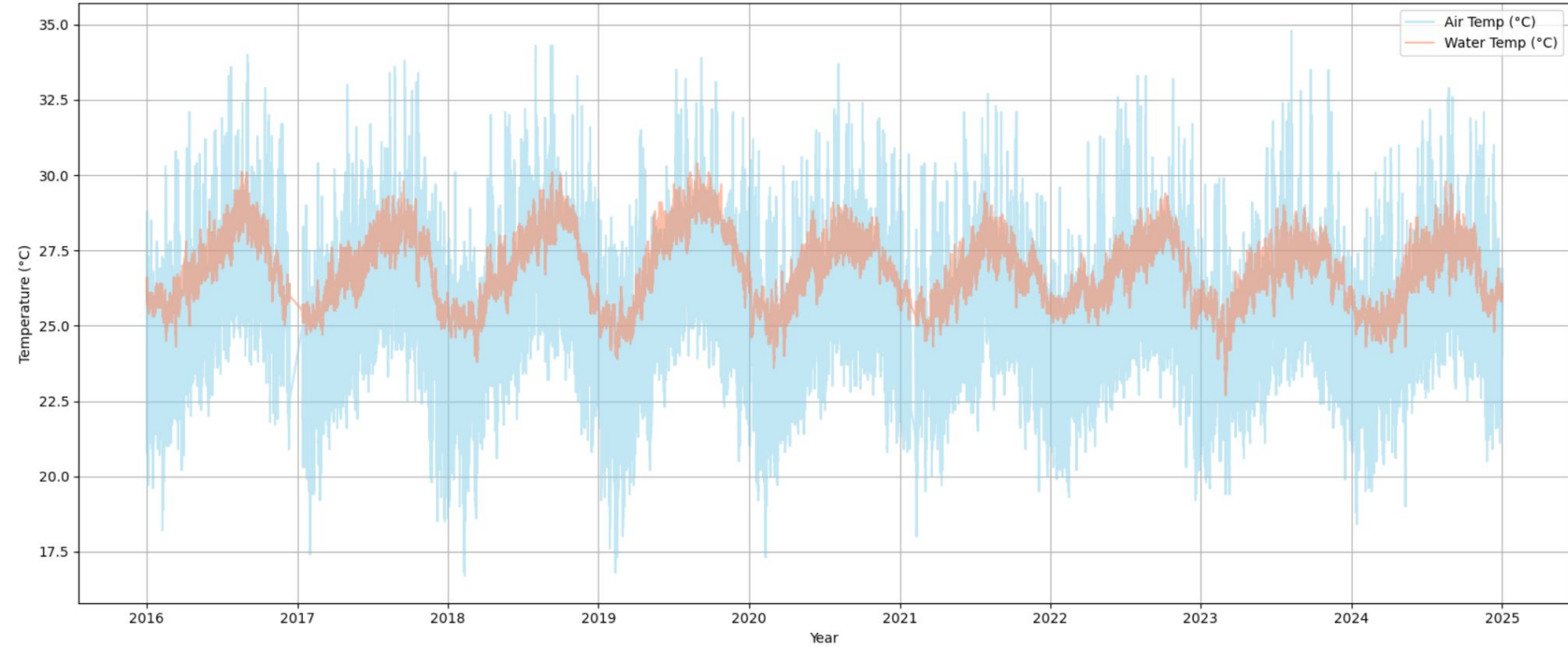
- **Pandas:** library for data manipulation and analysis, especially useful for working with structured data (used for datasets)
- **Numpy:** library for numerical computing, designed to handle arrays and matrices, and perform efficient numerical operations
- **Matplotlib:** (.pyplot & .dates) plotting library for creating static, interactive, and animated visualizations in Python (used for visual graphs and plots to show data)
- **Xarray:** a library designed for working with multi-dimensional datasets and especially useful for time series data, geospatial data
- **Cartopy:** a library for cartographic projections and mapping, good for visualizing geographical data like ocean currents or wave pattern
- **Seaborn:** a visualization library for statistical graphs

Used above packages in code to visualize long-terms patterns in air and sea surface temperatures, create comparative temperature plots across multiple years, and identify anomalies and relate them to known climate events.

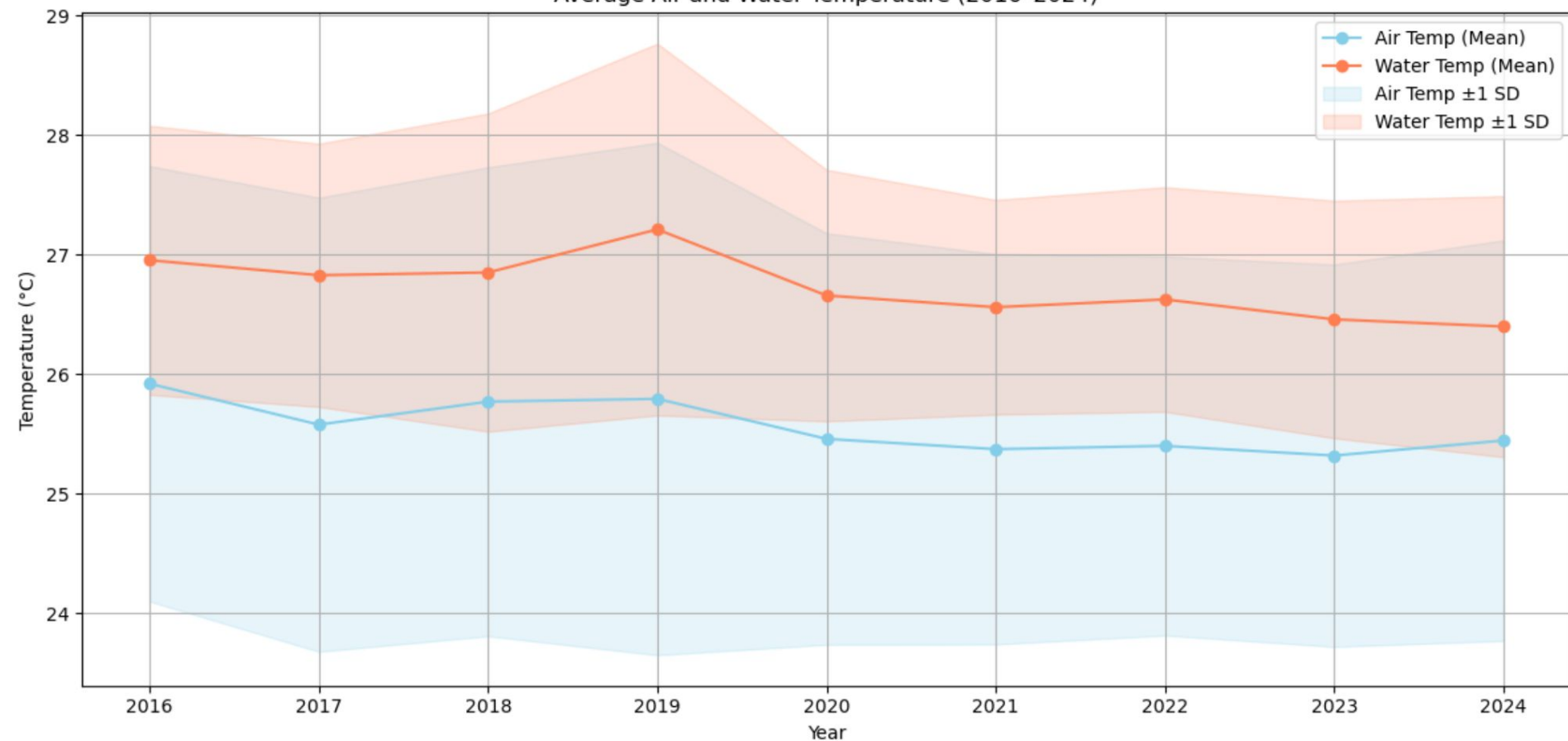
Station 51210 - Kaneohe Bay, HI



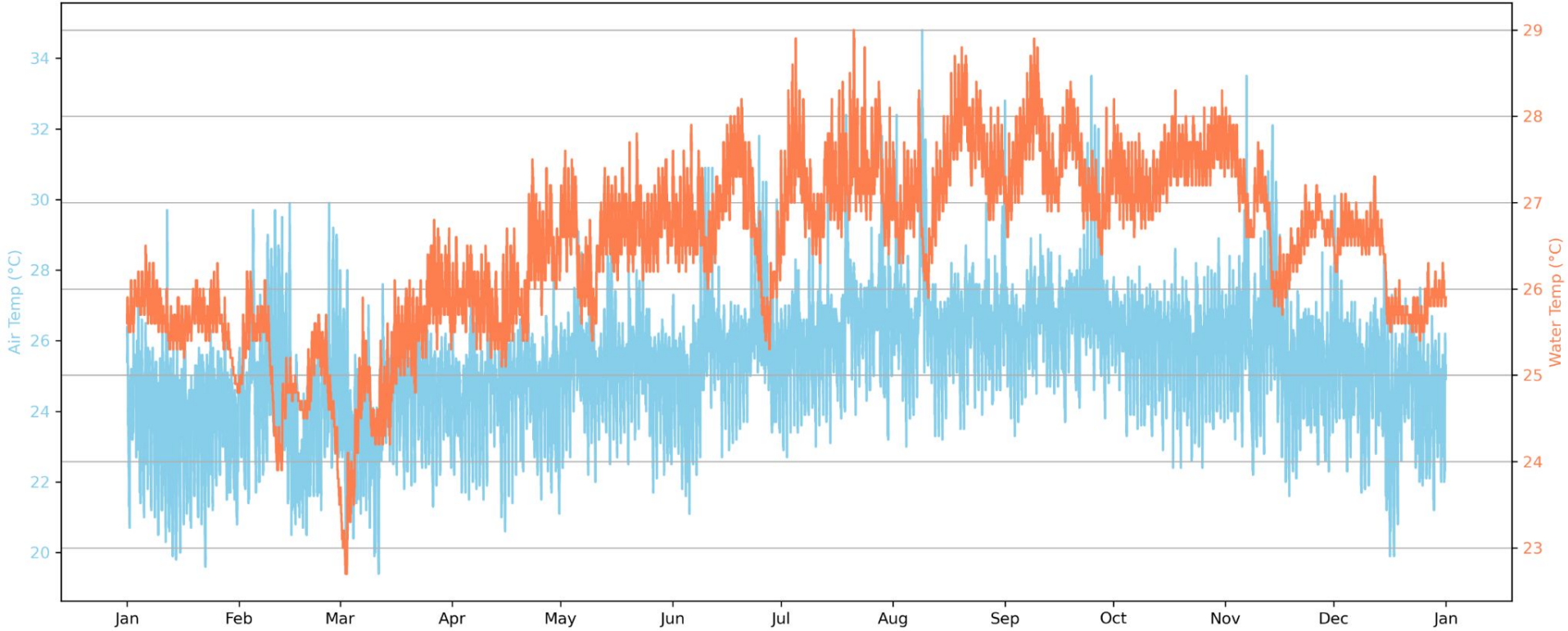
Air & Water Temperature (2016-2024)



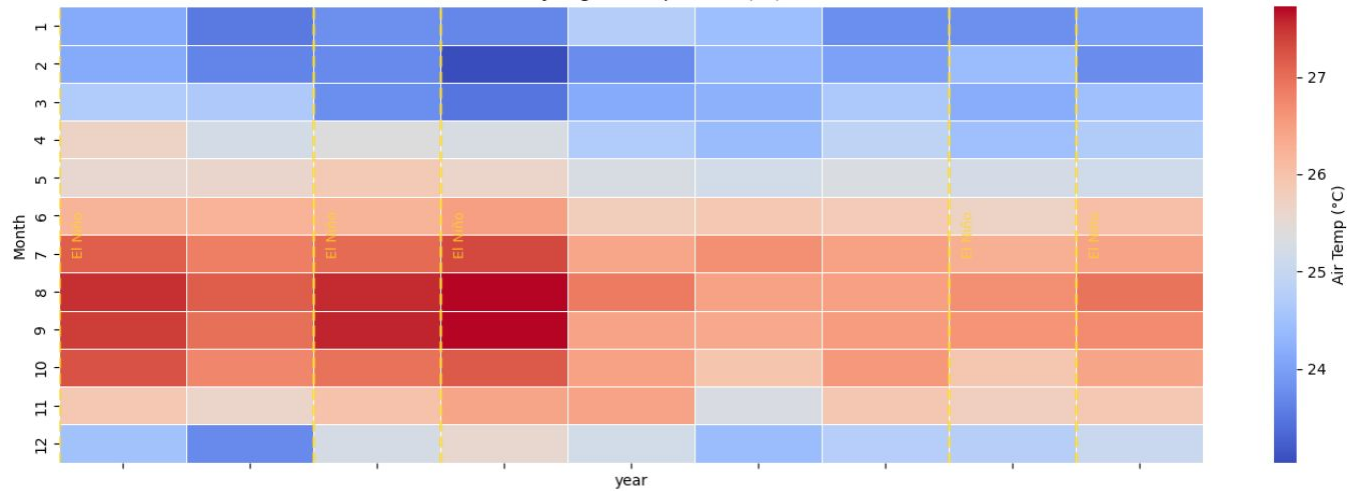
Average Air and Water Temperature (2016-2024)



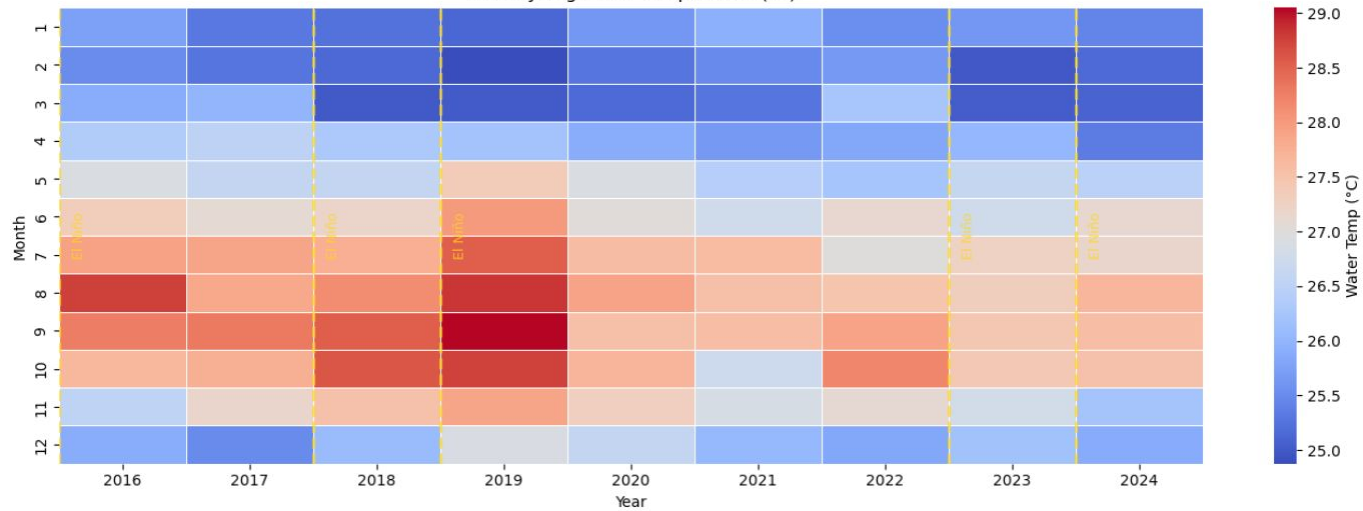
Air vs Water Temperature - 2023



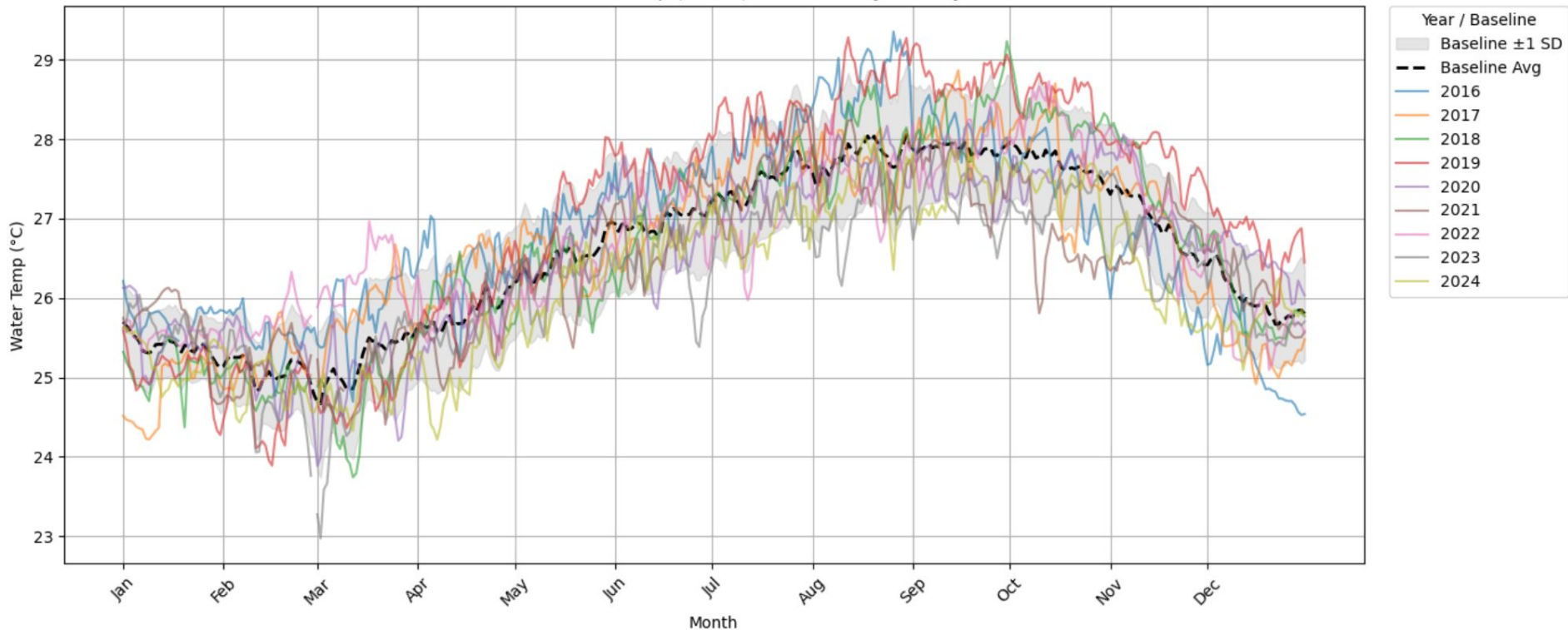
Monthly Avg Air Temperature (°C)



Monthly Avg Water Temperature (°C)



Seasonal Water Temp (WTMP) with Anomaly Overlay



Implications and Analysis

- Found common trends between the two variables (air/sea surface temp)
- El Nino years display correlation best
- Certain years/months are outliers (2016, 2023)
- Anomalies can be correlated to to known climate events (El Niño)

Limitations and Weaknesses

- Data missing labels
- Data missing units
- Too broad start of problem statement, multiple refinements
 - Waves
- Time constraints
- Outside factors affecting groupmates slowing down the process
- Git push issues
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Summary

- Air and water temperatures showed consistent seasonal cycles across all years.
- 2023–2024 had clear temperature anomalies consistent with El Niño effects.
- Rolling averages and anomaly plots revealed warming trends, particularly in surface waters.
- Heatmaps and time-depth plots demonstrated thermocline behavior and surface stratification.