Final Presentation:

Ocean Air and Water

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

Problem Statement:

How do ocean and air 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

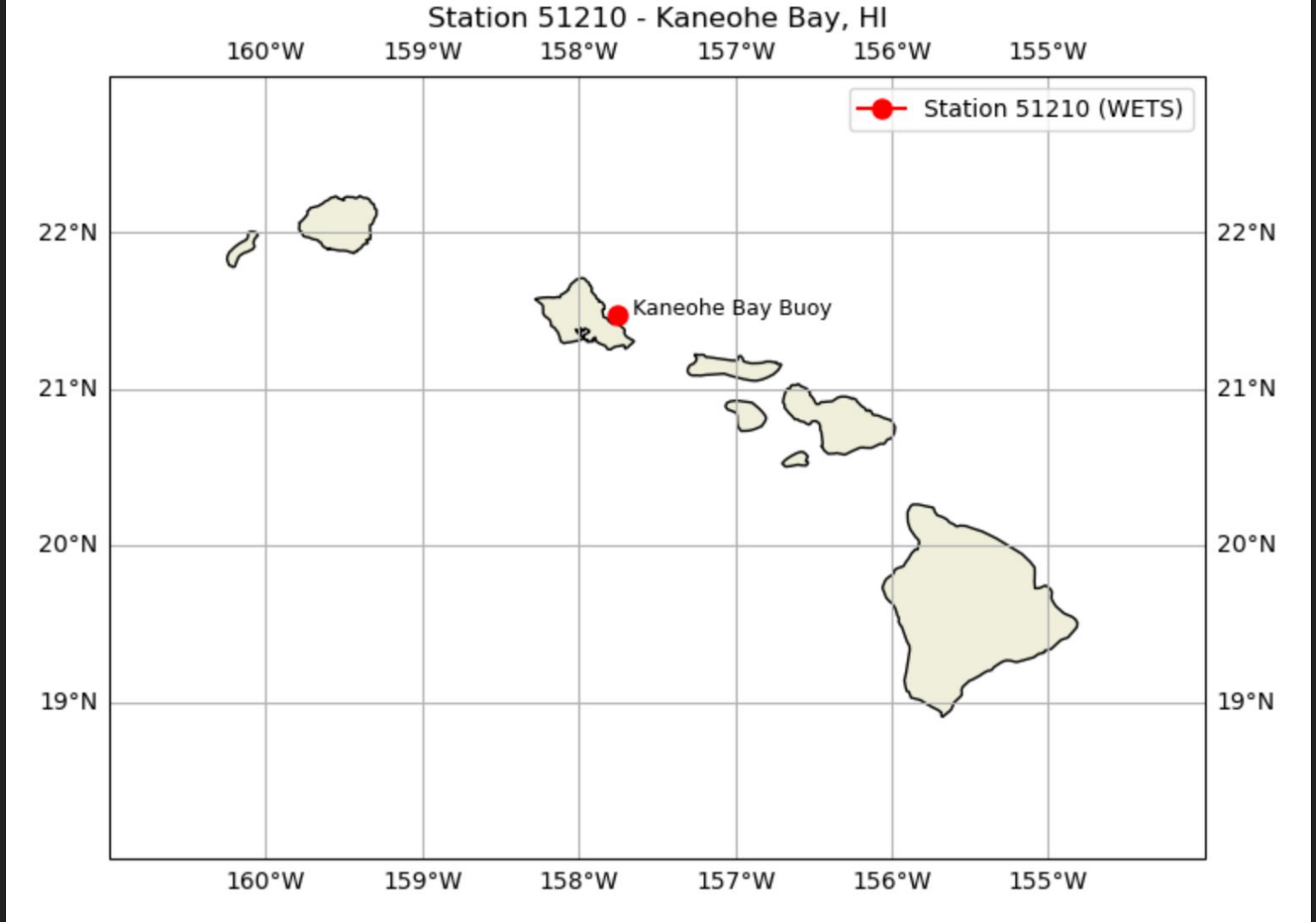
NOAA Air Temperature (2016-2024)

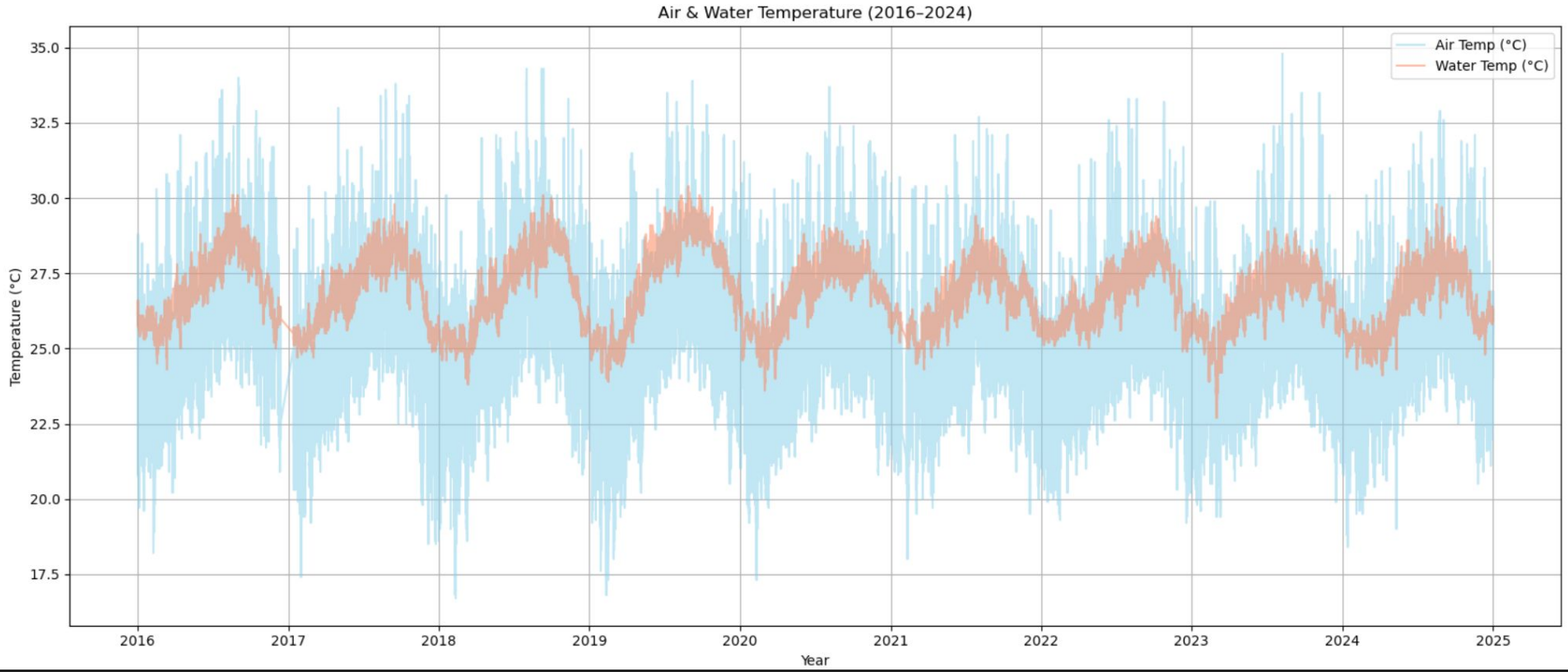
https://www.ndbc.noaa.gov/station_history.php?station=51210

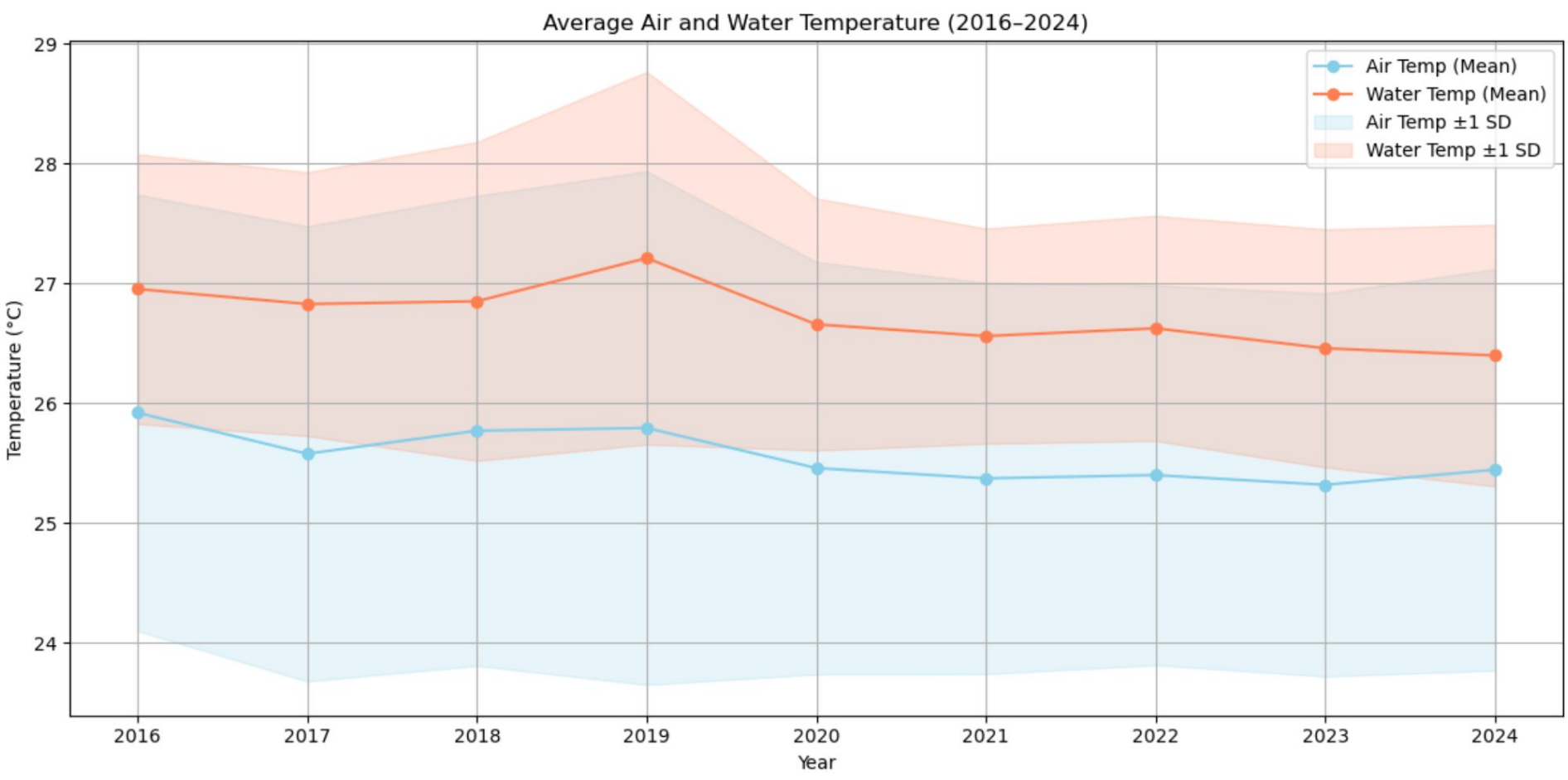
Methodology/Packages

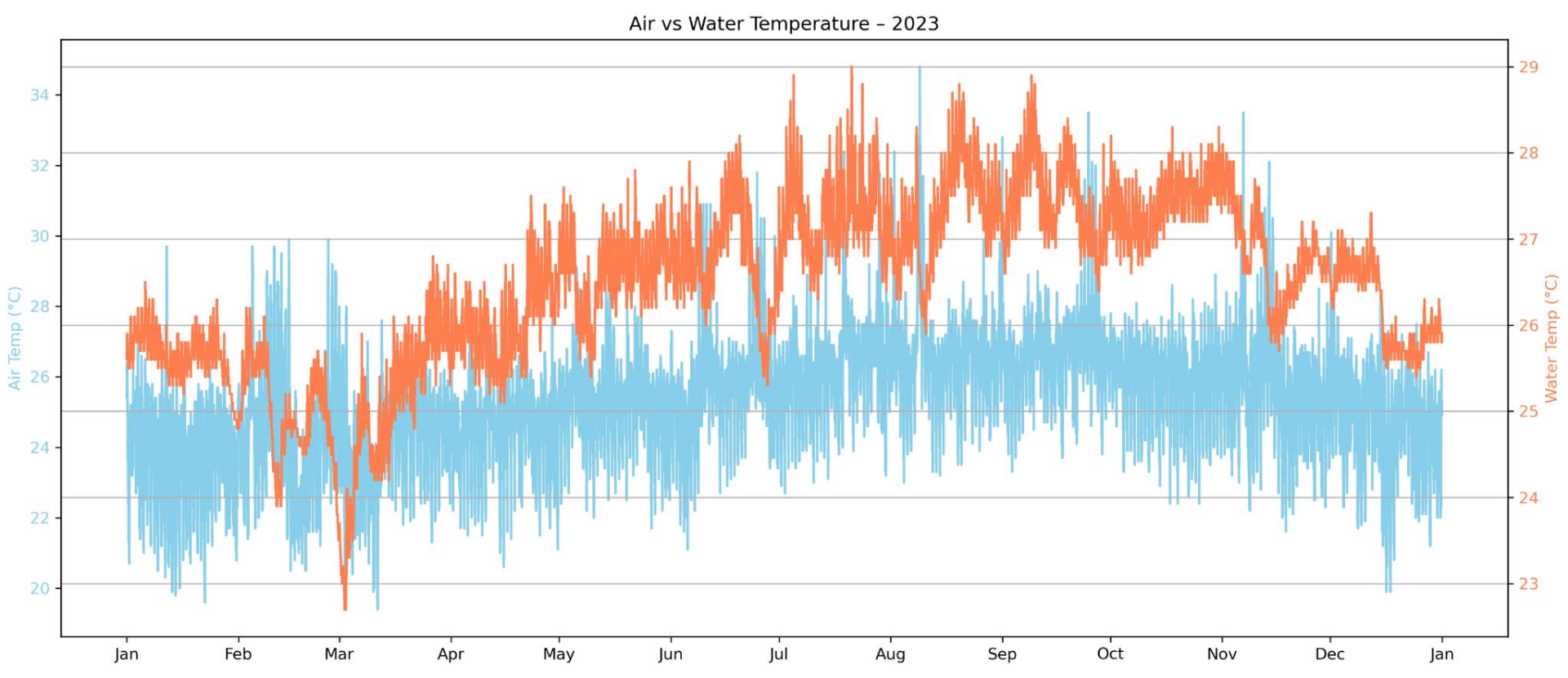
- **Pandas**: library for data manipulation and analysis, especially useful for working with structured data (used for datasets)
- **Numpy**: library for numerical computing, designed to handle arrays and matrices, and perform efficient numerical operations
- **Matplotlib**: (.pyplot & .dates) plotting 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

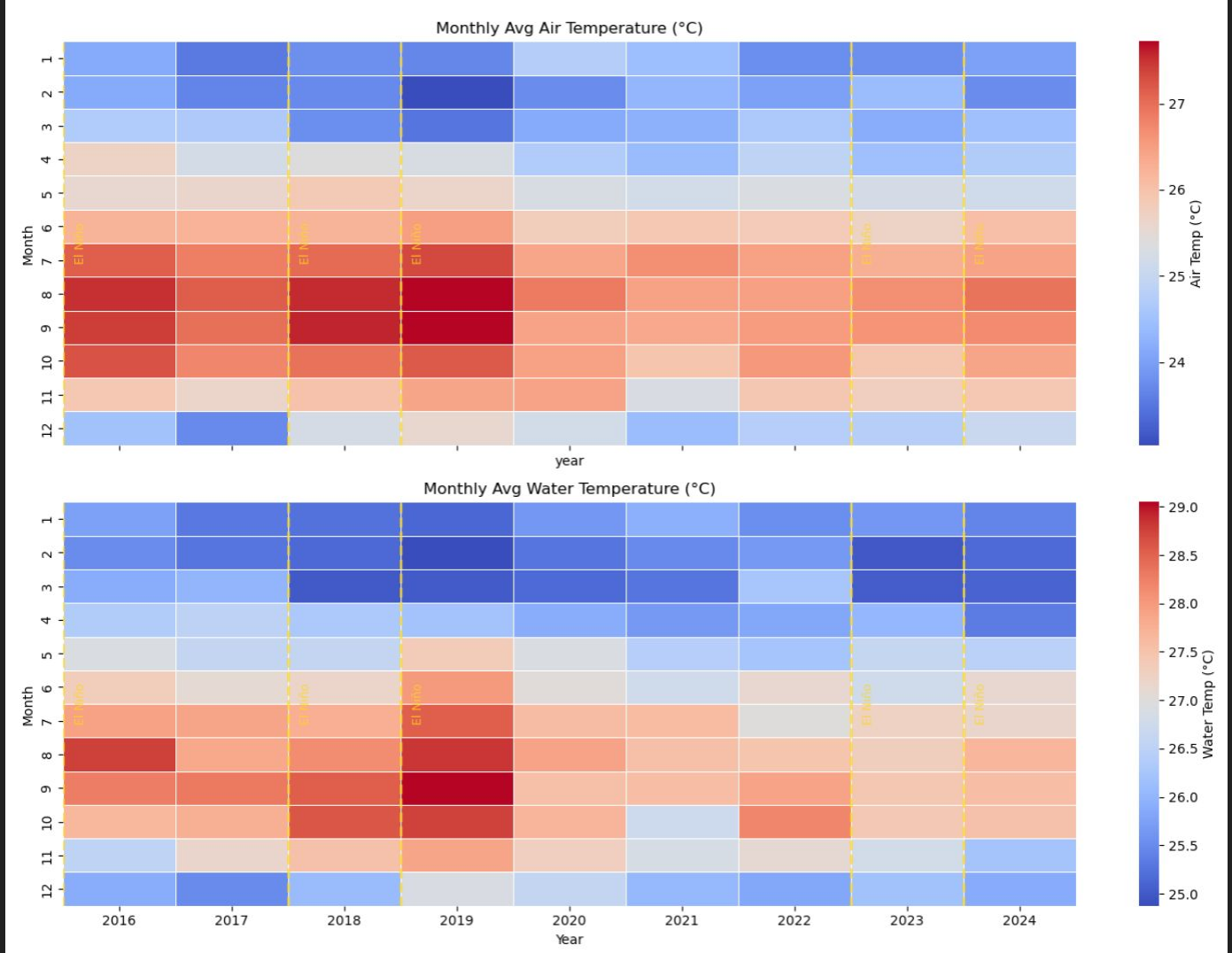
Used above packages in code to visualize long-terms patterns in air and sea surface temperatures, create comparative temperature plots across multiple years, and identify anomalies and relate them to known climate events.

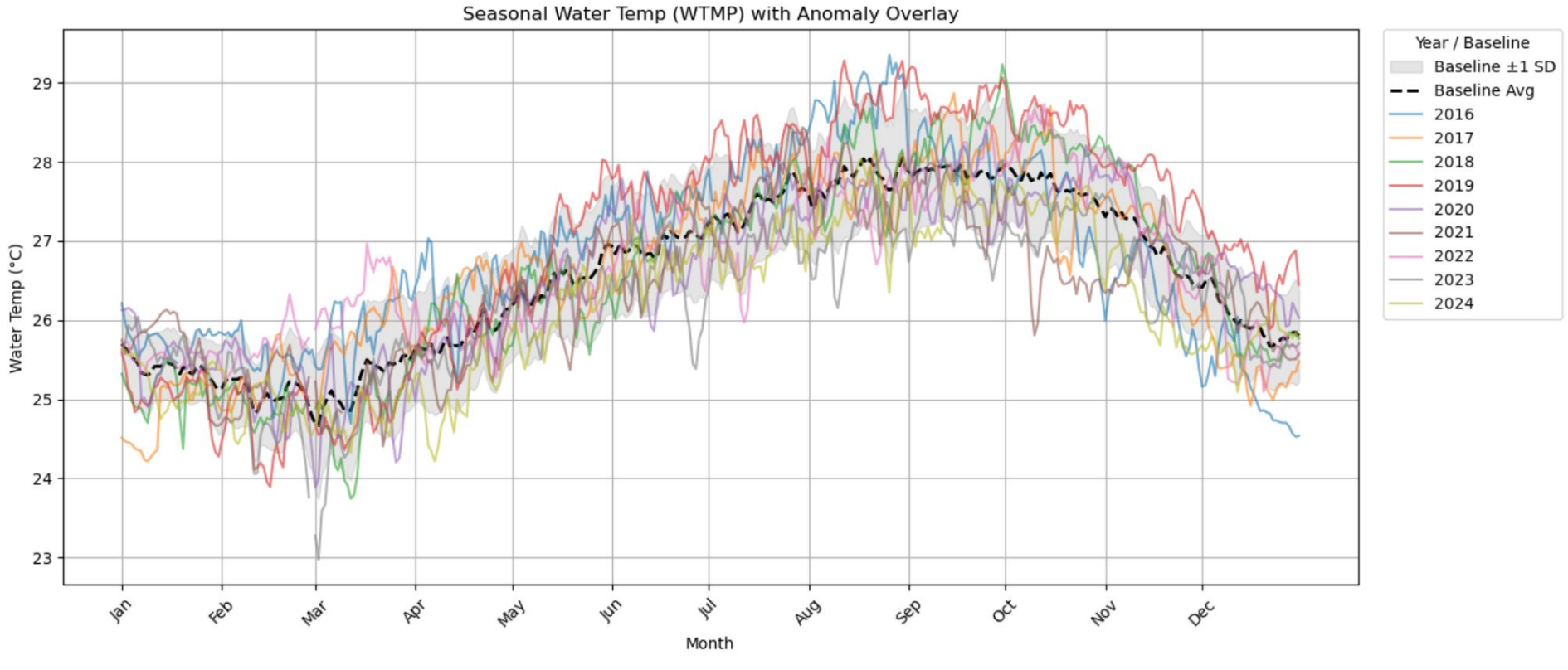

Station 51210 - Kaneohe Bay, HI
160°W
159°W
158°W
157°W
156°W
155°W
Station 51210 (WETS)
Kaneohe Bay Buoy
22°N
21°N
20°N
19°N


Air & Water Temperature (2016–2024)
Air Temp (°C)
Water Temp (°C)
Temperature (°C)
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Year


Average Air and Water Temperature (2016–2024)
Air Temp (Mean)
Water Temp (Mean)
Air Temp ±1 SD
Water Temp ±1 SD
Temperature (°C)
29
28
27
26
25
24
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year


Air vs Water Temperature – 2023
Air Temp (°C)
Water Temp (°C)
34
32
30
28
26
24
22
20
29
28
27
26
25
24
23
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan


Monthly Avg Air Temperature (°C)
Month
year
El Niño
Air Temp (°C)
27
26
25
24
Monthly Avg Water Temperature (°C)
Month
Year
2016
2017
2018
2019
2020
2021
2022
2023
2024
Water Temp (°C)
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
25.0


Seasonal Water Temp (WTMP) with Anomaly Overlay
Water Temp (°C)
29
28
27
26
25
24
23
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Year / Baseline
Baseline ±1 SD
Baseline Avg
2016
2017
2018
2019
2020
2021
2022
2023
2024

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

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.