Hilo Bay Water Resources

Monitoring Water Quality in Hilo Bay, Hawai'i to Support Future Community Planning

Project Synopsis

The waters in Hilo Bay are culturally and recreationally vital. Brown Water Advisories (BWA) warn the community of water quality risks from runoff or wastewater. This study leveraged Earth observation data from Sentinel-2 MSI, Landsat 8 OLI, Landsat 9 OLI-2, and Aqua/Terra MODIS to analyze turbidity and chlorophyll-a, as well as their potential connection to BWA. Results from the Optical Reef and Coastal Area Assessment (ORCAA) Tool revealed high turbidity values coinciding with most BWA, while analysis of MODIS data demonstrated no clear association between BWA and chlorophyll-a values. Earth observation data can be used to supplement *in situ* water quality monitoring methods, enhancing end-user's decision-making.

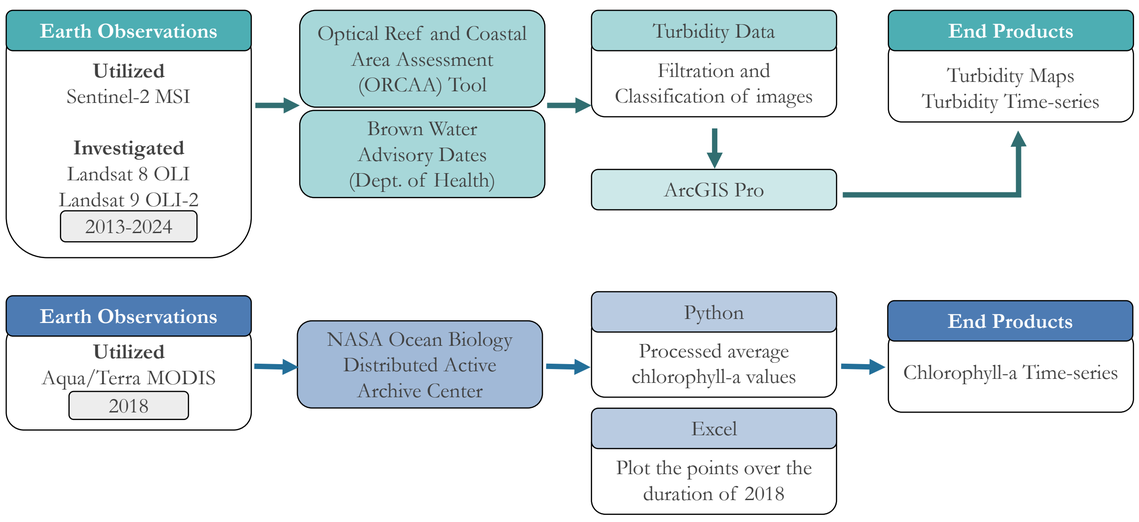
Objectives

- **Analyze** water quality parameters (turbidity & chlorophyll-a) in the Hilo Bay Region
- **Generate** water quality time-series that showcase periods of Brown Water Advisories and non-Brown Water Advisories
- **Produce** useful water quality maps for end-user decision making and an educational brochure for community engagement

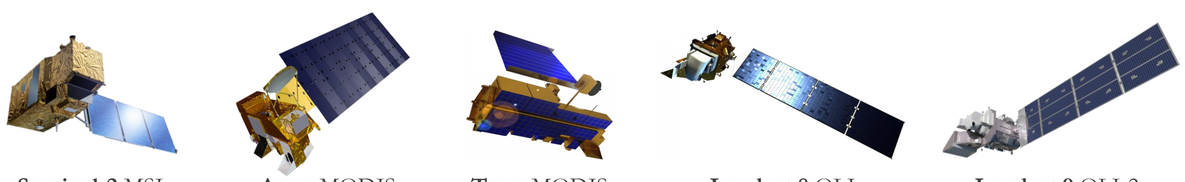
Project Partners

- County of Hawaii's Office of Sustainability, Climate, Equity, and Resilience

Methodology

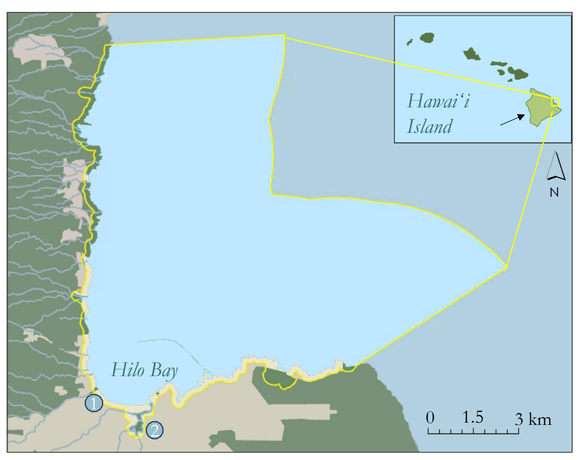


Earth Observations



Sentinel-2 MSI | **Aqua** MODIS | **Terra** MODIS | **Landsat 8** OLI | **Landsat 9** OLI-2

Study Area



Study Area:
Hilo Bay Region, Hawai'i
Study Period:
February 2013 to June 2024

Study Area
Urban Land Use District
Streams
1 Wailuku River
2 Wailoa River

Team Members

Danielle Sonobe, Project Lead
Samantha White-Murillo
Kandi Shimabukuro
Ashley Clark

Results

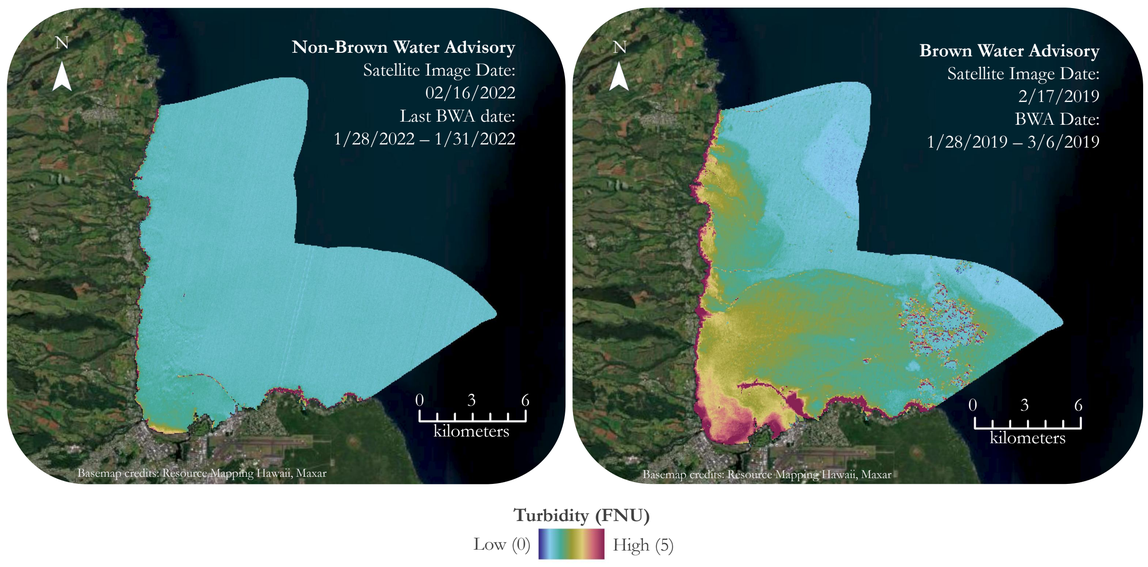


Figure 1. Sentinel-2 MSI images captured during Non-BWA day in 2022 (left) vs. BWA day in 2019 (right) showing turbidity patterns in the study area. Dark magenta indicates high turbidity in the bay, as well as major plumes along the northern coast.

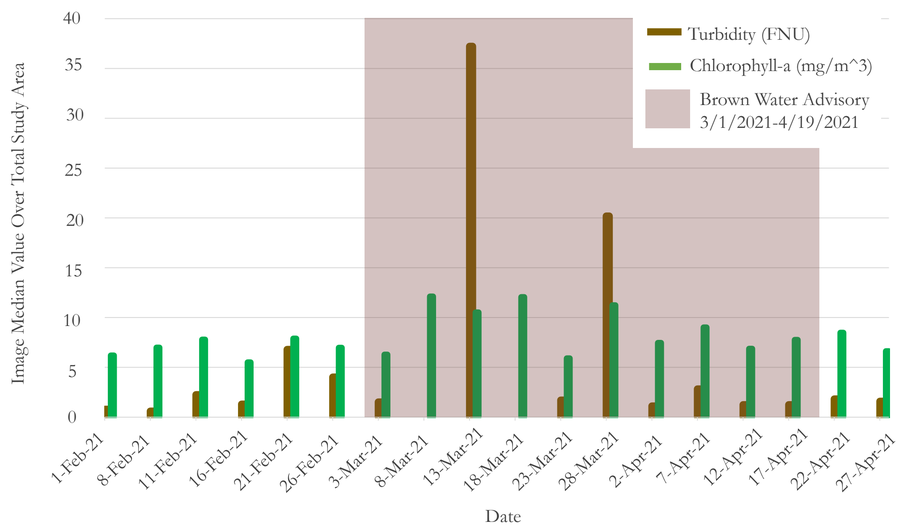


Figure 2. Turbidity (brown) and chlorophyll-a (green) values before, during, and after a BWA from the ORCAA tool. Visual assessment shows turbidity alignment with BWA, but no strong association between chlorophyll-a and BWA.

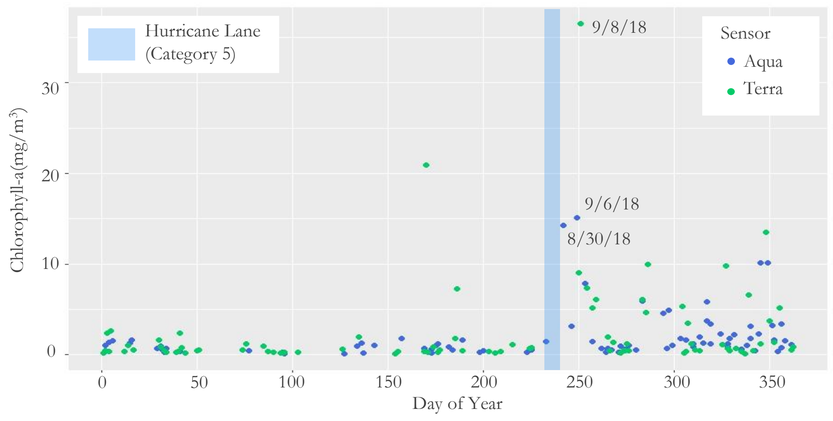


Figure 3. 2018 Aqua/Terra MODIS chlorophyll-a data from exploratory data acquisition. Chlorophyll-a values within the Hilo Bay region are respresented in blue for sensor: Aqua, and green for sensor: Terra. Maximum remotely sensed chlorophyll-a values occured within 2 weeks following Hurricane Lane.

Conclusions

- Turbidity plumes can be visually identified using satellite imagery and shows a considerable increase during most BWAs.
- This study found no association between chlorophyll-a and BWA in the Hilo Bay region.
- Sentinel-2 MSI data were most effective for turbidity monitoring over our study area, while Aqua/Terra MODIS shows potential for further investigation of chlorophyll-a.
- A multi-sensor approach can provide valuable insights to water quality conditions in Hilo Bay.

Acknowledgements

- **Science Advisors:** Dr. Robin Martin (Arizona State University), Dr. Kelly Hondula (Arizona State University), Dr. Xia Cai (Langley Research Center), and Dr. Kenton Ross (Langley Research Center)
- **Partners:** Bethany Morrison, Kendra Obermaier, Kevin Sullivan, and Erik Lash
- **Project Coordination Editor:** Kaitlyn L. Lemon (Idaho – Pocatello)
- **Lead:** Maya L. Hall (California – Ames)

This material is based upon work supported by NASA through contract 80LARC23FA024. Any mention of a commercial product, service, or activity in this material does not constitute NASA endorsement. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.