

National Aeronautics and Space Administration



HILO BAY WATER RESOURCES

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

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Land Acknowledgement

Our team acknowledges that the 'āina (land) which this project has grown out of is the ancestral homeland of Kanaka Maoli (Native Hawaiians). It is because of them, that we can be here today. As visitors and settlers, aloha 'āina in the moku of Hilo on Hawai'i Island, we are deeply grateful for the generations of Native Hawaiians who have stewarded, cared for, and honored this 'āina over the past 1,600 years.

Ola i ka wai... Water is life!



Meet the Team



Dani Sonobe

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Study Area & Period

Study Area:

Hilo Bay Region, Hawaiʻi

Study Period: February 2013 to June 2024

Study Area

Urban Land Use District

Streams







Community Concerns







The Hilo Bay Region places in the 89th percentile in the USA for **risk from wastewater discharge** Silt and contaminants present in brown water threaten native and endangered wildlife

Hazardous water quality inhibits cultural and recreational use

Objectives





Generate a set of water quality time-series that showcase periods of Brown Water Advisories (BWA) and non-Brown Water Advisories



Produce useful water quality maps for end-user decision making and an educational brochure for community engagement



The County of Hawai'i Office of Sustainability, Climate, Equity and Resilience (OSCER)



Mission: Create lasting, sustainable and immediate change

to achieve sustainability, climate, equity and resilience goals within the local community

Earth Observations

Data Acquisition Periods



Methodology: ORCAA



Methodology: MODIS



Results: Image Availability During BWA

Sentinel-2 MSI (10 m) 22 viable images captured during BWA



Landsat 8 OLI (30m) 1 viable image captured during BWA



Results: Non-BWA vs BWA

Non-Brown Water Advisory



Brown Water Advisory



Satellite Date: 02/16/2022 Last BWA date: 1/28/2022 – 1/31/2022 Turbidity (FNU)



Satellite Date: 2/17/2019 BWA Date: 1/28/2019 - 3/6/2019

Image Credits: DEVELOP Hilo Team

Results: Non-BWA vs BWA

Before BWA February 1-28, 2021 **Beginning of BWA** March 1-14, 2021 **Middle of BWA** March 15-31, 2021

End of BWA April 1-19, 2021



Image Date: 2/6/2021

Image Date: 3/3/2021

Image Date: 3/23/2021

Image Date: 4/17/2021



Turbidity (FNU)

Image Credits: DEVELOP Hilo Team

Results: Turbidity Plumes



Turbidity plumes: areas of higher turbidity on and extending offshore



Image Credits: DEVELOP Hilo Team

Results: Turbidity Time Series



Case Studies: Turbidity and Precipitation during BWAs

Hurricane Lane (8/15/18 - 8/29/18) BWA: 8/24/18 - 8/31/2018



 Average Daily Precipitation (mm)

Turbidity (FNU) Image Median Value over total study area



2018 MODIS (Aqua/Terra) Chl-a Values



Date

Example of Temporal Data: MODIS (Aqua/Terra)



Chlorophyll-a (L2)



Errors & Uncertainties

Image Availability

Study Area Conditions

Coastal Remote Sensing Algorithms



Cloud & atmospheric interference







Wave influence



Data validation

Feasibility & Partner Implementation

Earth observations are **feasible** for analyzing water quality parameters in the Hilo Bay region

Remote sensing methods provide turbidity and chlorophyll-a data at high temporal and spatial frequencies, which enable **effective longterm monitoring**

Identification of Brown Water Advisories and turbidity plumes through the ORCAA tool proves **promising** for future water quality management

Conclusions



Turbidity shows a **considerable increase** during most Brown Water Advisories



Turbidity plumes can be **visually identified** using satellite imagery



No association was observed between chlorophyll-a and turbidity in the Hilo Bay region



A multi-sensor approach can provide **valuable insights** to water quality conditions in Hilo Bay

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