

DETECTION AND MONITORING OF HARMFUL ALGAL BLOOMS (HABs) USING SATELLITE BASED PRODUCTS ACROSS GULF OF MANNAR

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Abstract

Harmful Algal Blooms (HABs) are a growing environmental concern, impacting aquatic ecosystems, human health, and economies. Driven by factors like nutrient enrichment and climate change, HABs require effective monitoring to mitigate their impacts. Satellite-based products offer valuable insights by capturing large-scale, continuous data on water bodies. This study explores the use of satellite technologies to detect and monitor HABs, contributing to improved management and mitigation strategies.

Need for study

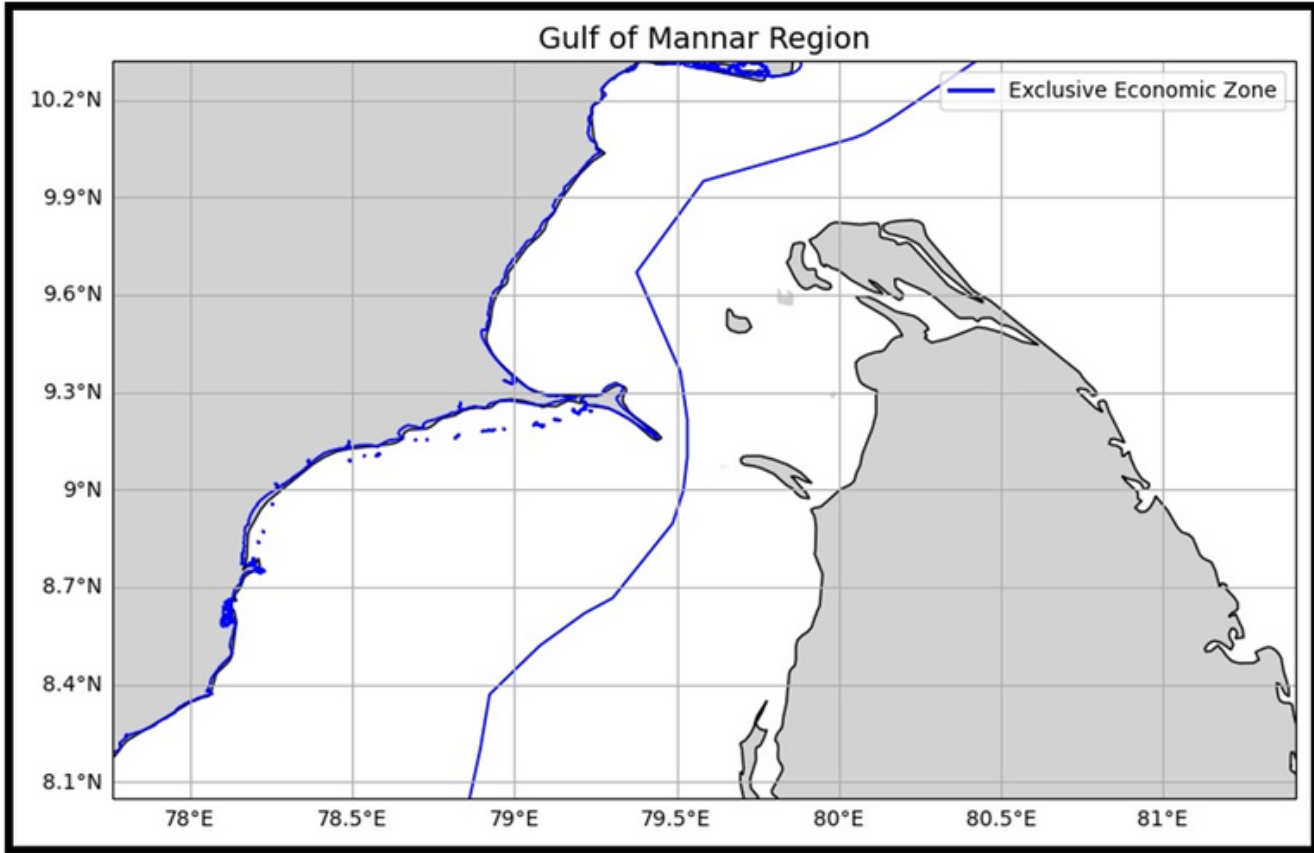
Harmful algal blooms (HABs) fueled by nutrient pollution and climate change, deplete oxygen levels, disrupt aquatic ecosystems, and release toxins harmful to marine life, humans, and livestock. HABs threaten fisheries, aquaculture, and tourism industries, causing economic losses and food security issues. Moreover, due to warming oceans and eutrophication it necessitates urgent research. Studying HABs helps in understanding their triggers, predicting outbreaks, and mitigating their impacts through effective management strategies. Focusing on three SDGs – SDG 3 (good health and well being); SDG 13 (climate action) and SDG 14 (life below water).

Objectives

- To map the Sea Surface Temperature, chlorophyll-a, Turbidity across the Gulf of Mannar
- To spatio-temporally monitor the progression and intensity of HABs.
- To detect the occurrence and spatial extent of Harmful Algal Blooms (HABs) and validate with L4 re-analysis data.

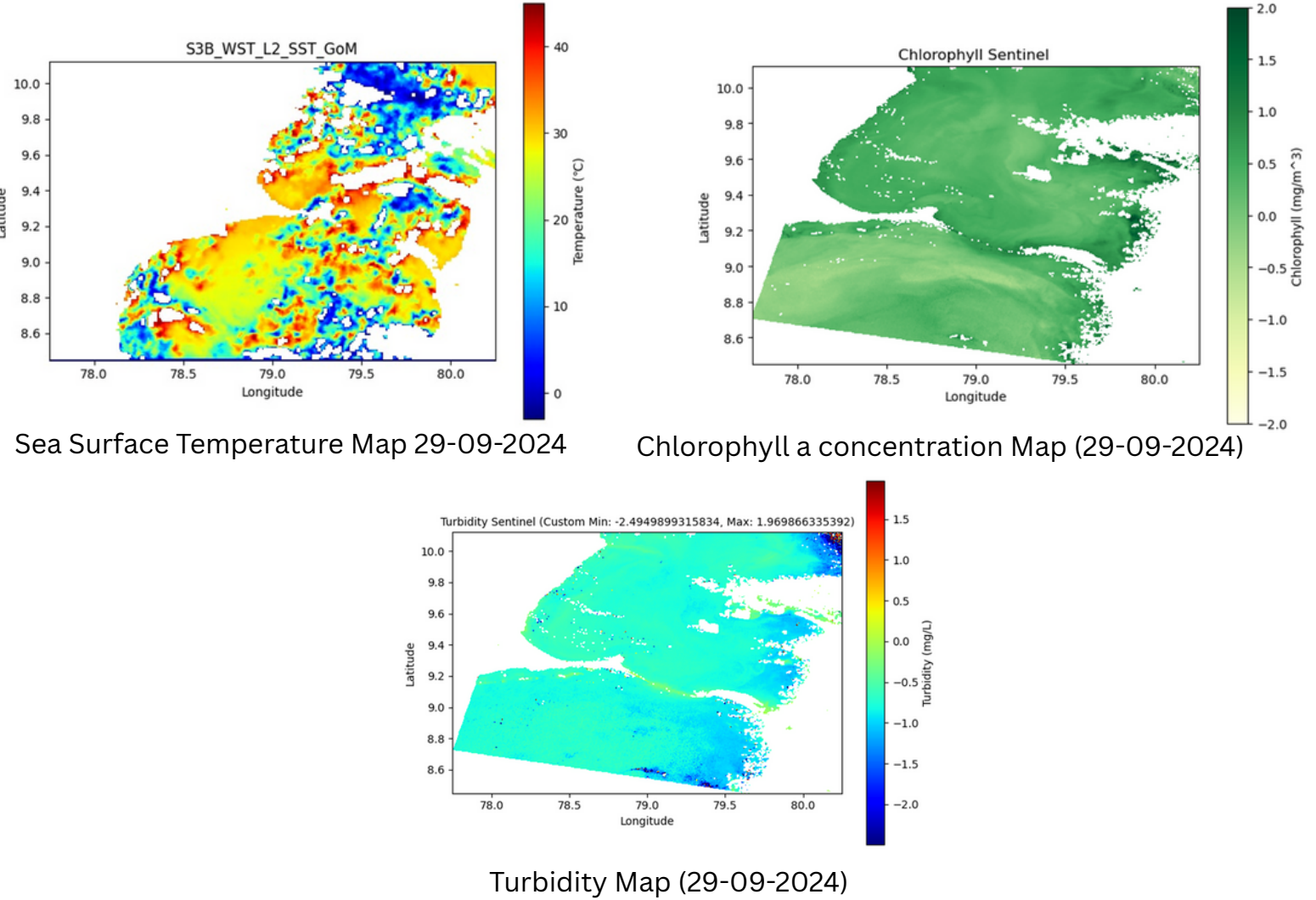
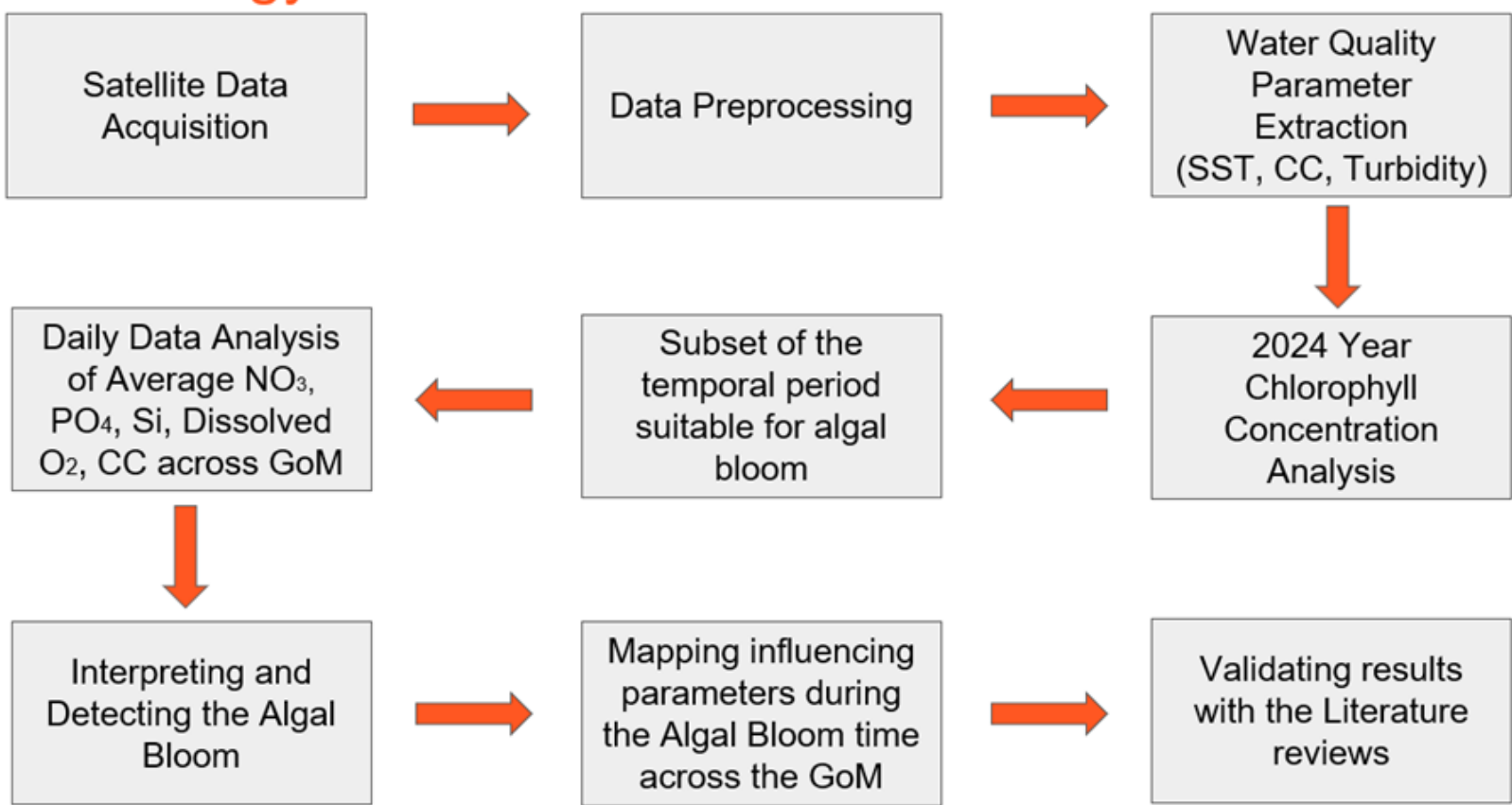
Data Used and Study Area

DATA SOURCE	RESOLUTION	VARIABLE
GLOBAL OCEAN BIOGEOCHEMISTRY ANALYSIS AND FORECAST	0.25° × 0.25°	Cholorophyll, Nitrate, Phosphate, Silicate, Dissolved oxygen
SENTINEL 3 (OLCI)	300 m	Chlorophyll
SENTINEL 3 (SLSTR)	1000 m	Sea Surface Temperature
SENTINEL 3 (OLCI)	300 m	Turbidity



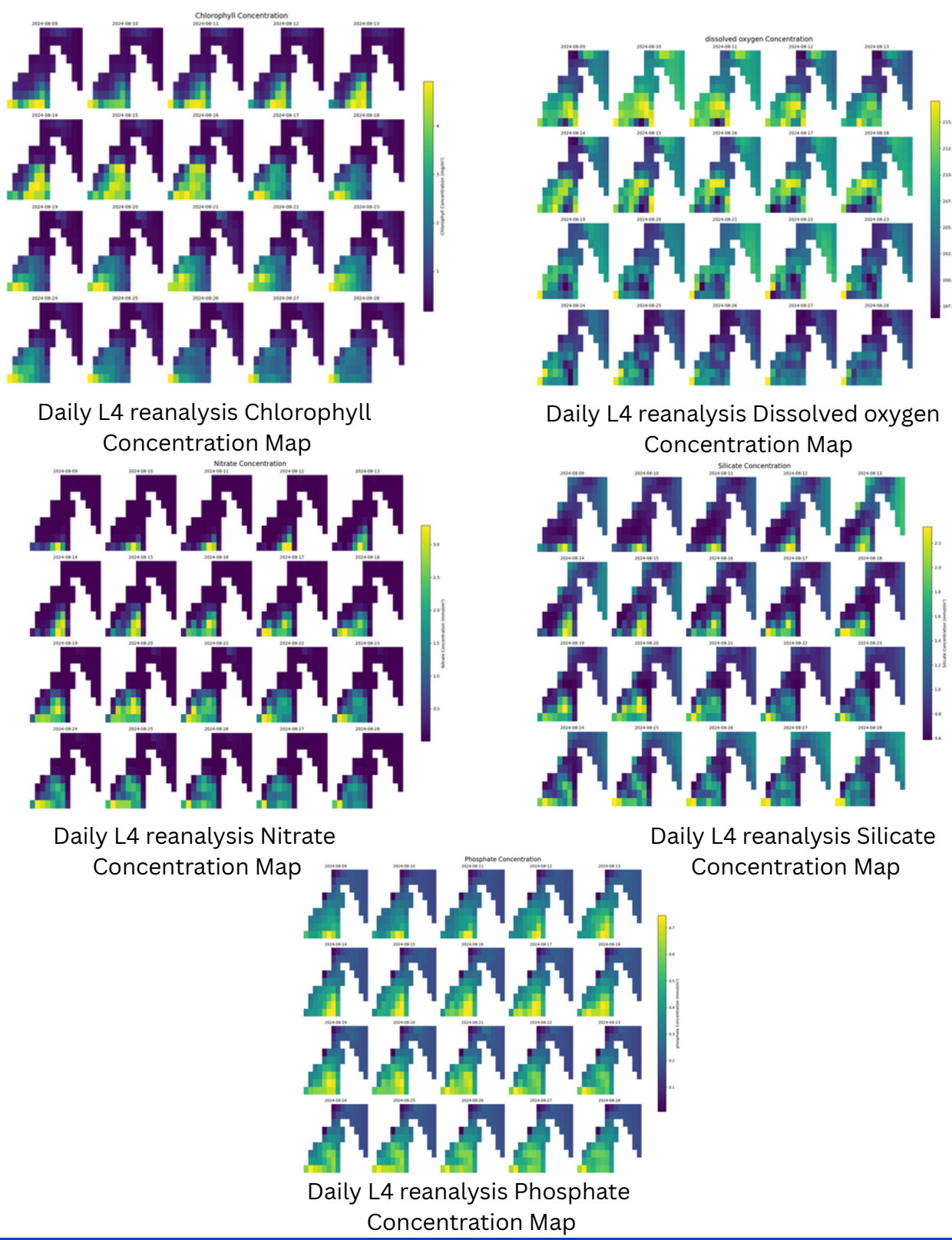
Methodology and Results

Methodology

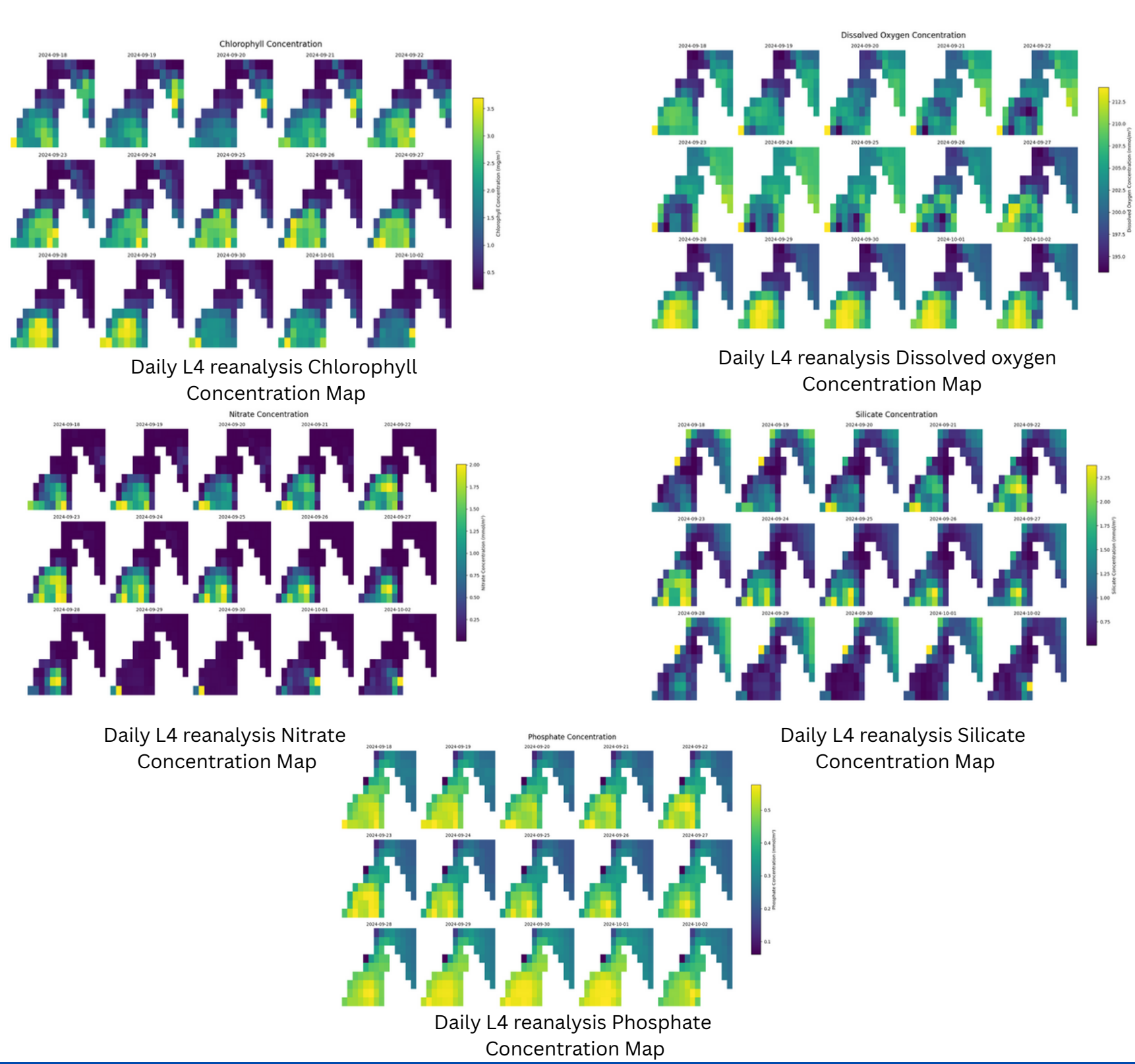


Algal Bloom Detections Maps

Algal Bloom Detection 1
(09-08-2024 to 28-09-2024)



Algal Bloom Detection 2
(18-09-2024 to 02-10-2024)



Conclusion

This study demonstrated the effective use of satellite remote sensing with water quality indicators to detect harmful algal blooms (HABs) in the Gulf of Mannar. Heatmap analysis confirmed bloom events between August 14–19 and September 18–October 2, 2024. High chlorophyll-a levels, along with SST and nutrients, enabled accurate prediction and monitoring. Seasonal bloom trends matched historical data, validating the method. The findings highlight a scalable, cost-effective system for HAB surveillance and coastal ecosystem management.