



# GWFF

GEOSPATIAL WORLD FORUM

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# Supporting Life Below Water from Space

Parya Pasha Zadeh , May 2024



NOORDWIJK



3 of 7  
people

depend on seafood as their main source of protein.



44%  
of world's population

lives within 150 kilometres of the ocean.



Up to 10x  
more carbon

is stored in coastal habitats than tropical forests per unit area.



UNITED NATIONS DECADE ON  
**ECOSYSTEM  
RESTORATION**  
2021-2030





### Four principles of successful restoration

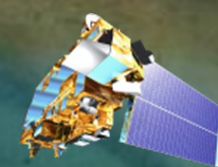
- 

1. Understand past and future conditions
- 

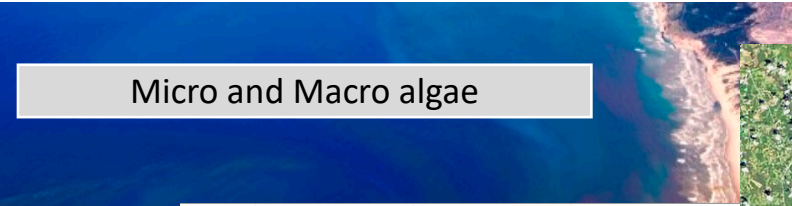
2. Promote ecological integrity
- 

3. Engage local communities
- 

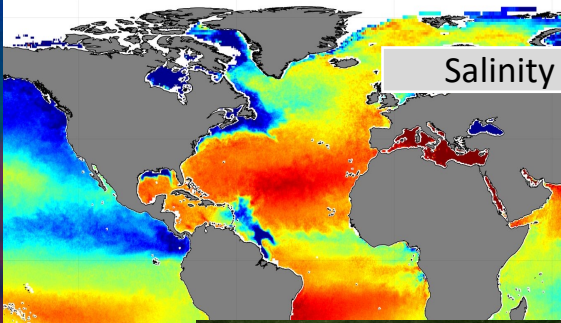
4. Sustainable over long term



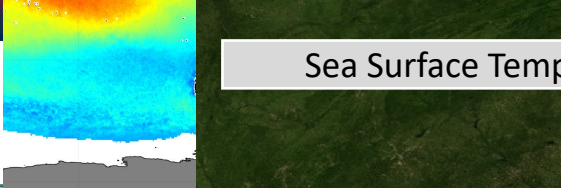
Micro and Macro algae



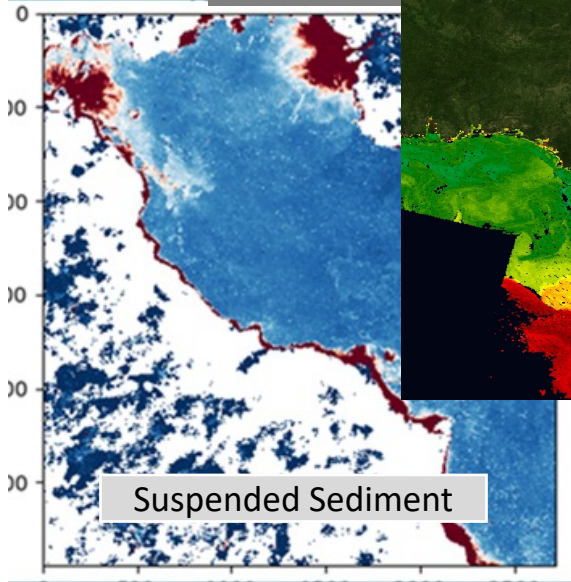
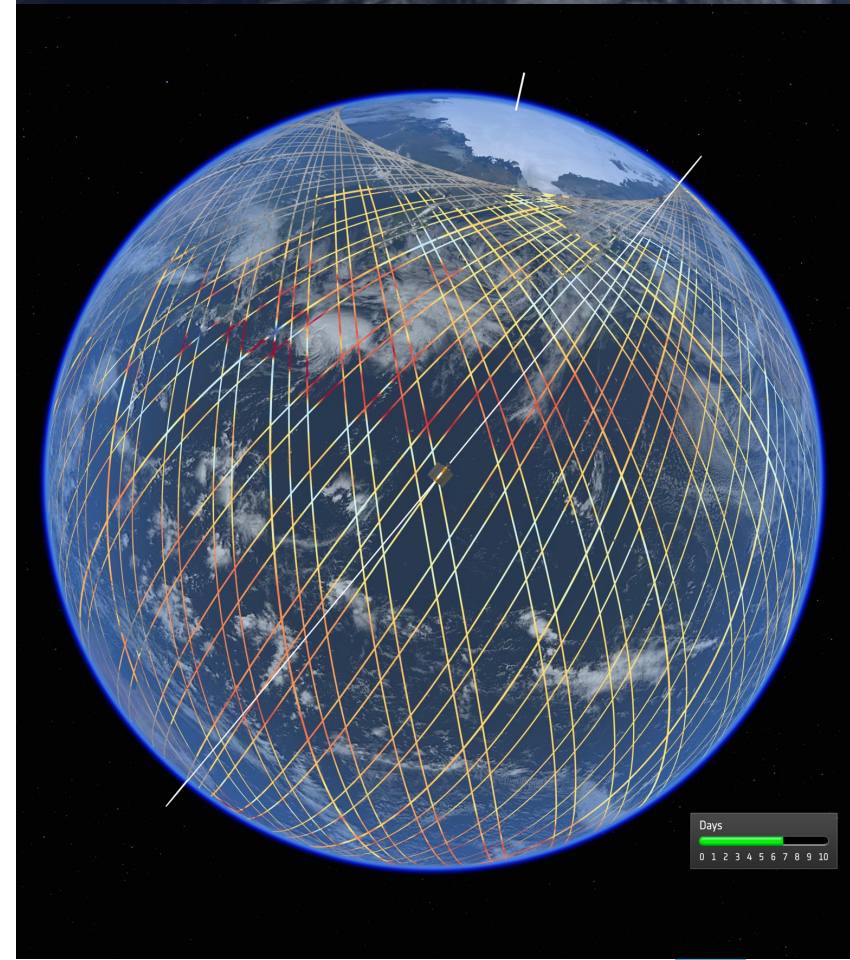
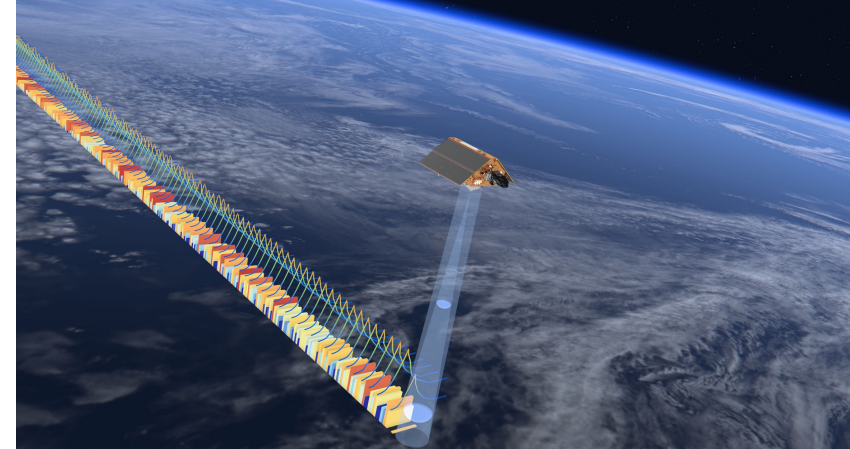
Salinity



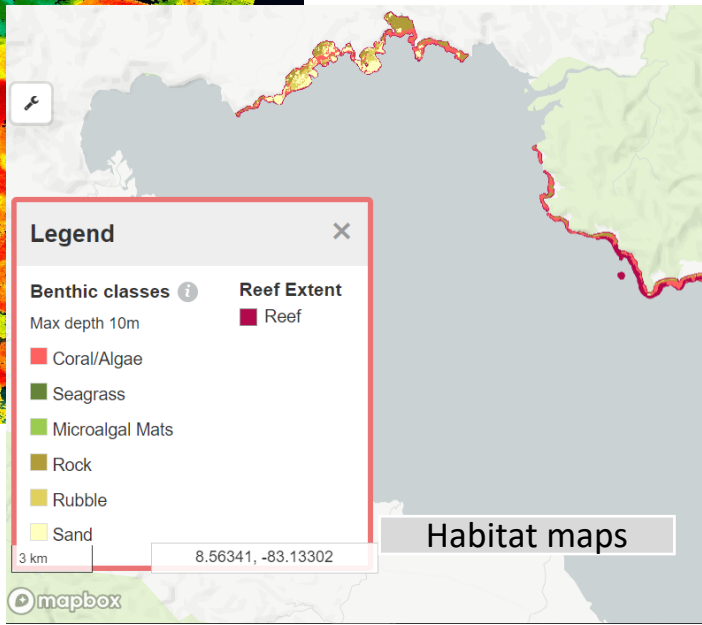
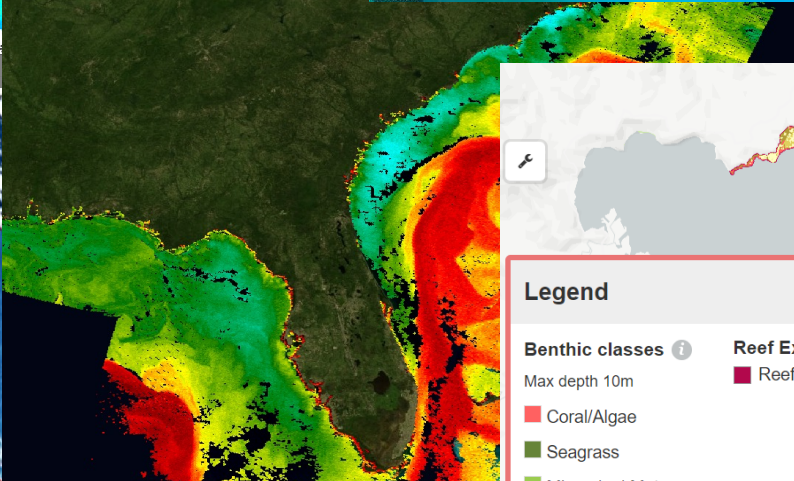
Sea Surface Temp



Land-based pollution



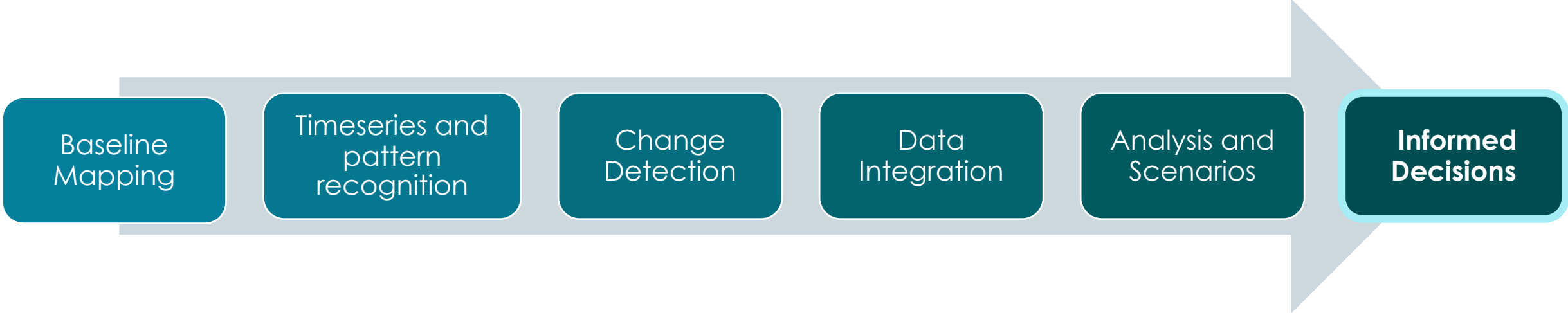
Suspended Sediment



Habitat maps



# GIS & Earth Observation for Decision making



## Management Decisions



## Monitoring and Evaluation

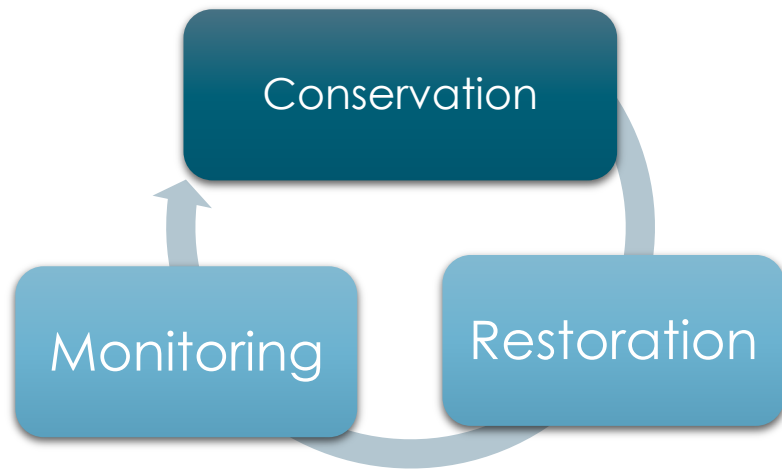


## Policy Recommendations



# Dutch Caribbean projects

- Caribbean research programmes receives boost of more than 7 million euros
- Champions group > Dutch Initiative for sharing expertise in effective management of climate change
- ESA and EU investments...





# Dutch Caribbean projects

The screenshot displays the DORY Coastal Data Viewer interface. The top left corner features the DORY logo (Coastal Data Viewer) and the marmoris logo. A search bar is present with the text "Search for locations". Below the search bar are buttons for "Explore map data" and "Upload". The interface shows a list of "DATA SETS (6)" with options to "Remove All" and "Collapse All". Two data layers are visible: "Reef extent (source: Allen Coral Atlas)" and "Dive centre locations". Both layers have an "IDEAL ZOOM" button, an "ABOUT DATA" button, and a "Single symbol" option. The "Reef extent" layer has an opacity slider set to 80%. The "Dive centre locations" layer also has an opacity slider set to 80%. The map shows the Dutch Caribbean region, including Aruba (Neth.), Curacao, and Bonaire. Key locations like Oranjestad, Willemstad, and various states (Falcon State, Yaracuy State, Miranda State) are labeled. A notification at the bottom of the map area states "6 datasets enabled on map". The bottom of the interface includes the Cesium Ion logo, a "Data attribution" link, a "Disclaimer" link, and a "Basemap" link. The current coordinates are displayed as "Lat 12.93390°N Lon 67.58731°W Elev 0m". A scale bar indicates 50 km. The bottom right corner of the slide shows the number "8".

# Dutch Caribbean projects

The screenshot displays the DORY Coastal Data Viewer interface. On the left, a dark blue sidebar contains the DORY logo, a search bar, and navigation buttons like 'Explore map data' and 'Upload'. Below these are controls for data sets, including 'Dive centre locations' and 'Bonaire - 10m Turbidity (1)', with an opacity slider and time selection tools. The main map area shows a satellite view of Bonaire with a white circle highlighting a specific location. A 'Feature Information' popup window is open, showing a line chart for 'Bonaire - 10m Turbidity (1) - Site Data' from 2017 to 2024. The chart shows a highly variable time series with values ranging from approximately 0.45 to 0.65. The interface also includes a top navigation bar with 'About', 'Related Maps', 'Map Settings', 'Help', 'Story', and 'Share / Print' buttons. A bottom timeline shows the current time as 24/12/2019, 12:25:10, with playback controls and a date range from 30/12/2017 to 30/12/2019.

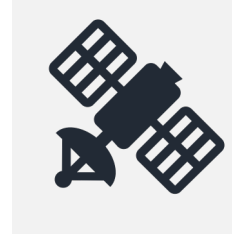
# Reducing the barriers...

## Potential end-users:

- NGO working on conversation and restoration
- Companies providing solutions for conservation and restoration practices (3d printed reefs!)
- Local and regional management of natural resources
- International development programmes
- Global conservation and development agencies



Easy access  
comprehensive data  
overview



Additional data-driven  
insights



Data integration multi-  
criteria analysis



Predictive modelling and  
decision support

# Filling in the gaps



## Data Integration

IoT and sensor integration

Drone deployment

Alerted Inspections

## Sensor Integration

Commercial VHR satellite

Radar data (SAR)

Aerial imagery

## Validation

Improving methods  
through ground truthing

Adjusting methods to local  
specifications

# Marmoris

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 Parya

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1 intro	2
1 coral and coastal habitat importance	2
1 problem statement and Jose Andres	3
1 solution satellite suspended sed	2
1 how we get info using AI from imagery - what we can extract out of it	5
1 details solution timeseries, anomaly, discovering land based pollutions land source	3
1 what other info ?	2
1 decision making, monitoring, evaluation	3
1 dutch caribbean examples and investments	1
Questions?? think about use cases together - refer to the morning session	5
1 Eyes in the Sky	3
1 limitations and considerations	2
1 complementary data	2
write up in the cards	5
needs from audience? What stops you?	3
1 wrapup, way forward, and needs from space sector	1

# Limitations

## Availability and Cloud cover

- You don't always have data/good data to see what you want to inspect!

## Temporal resolution

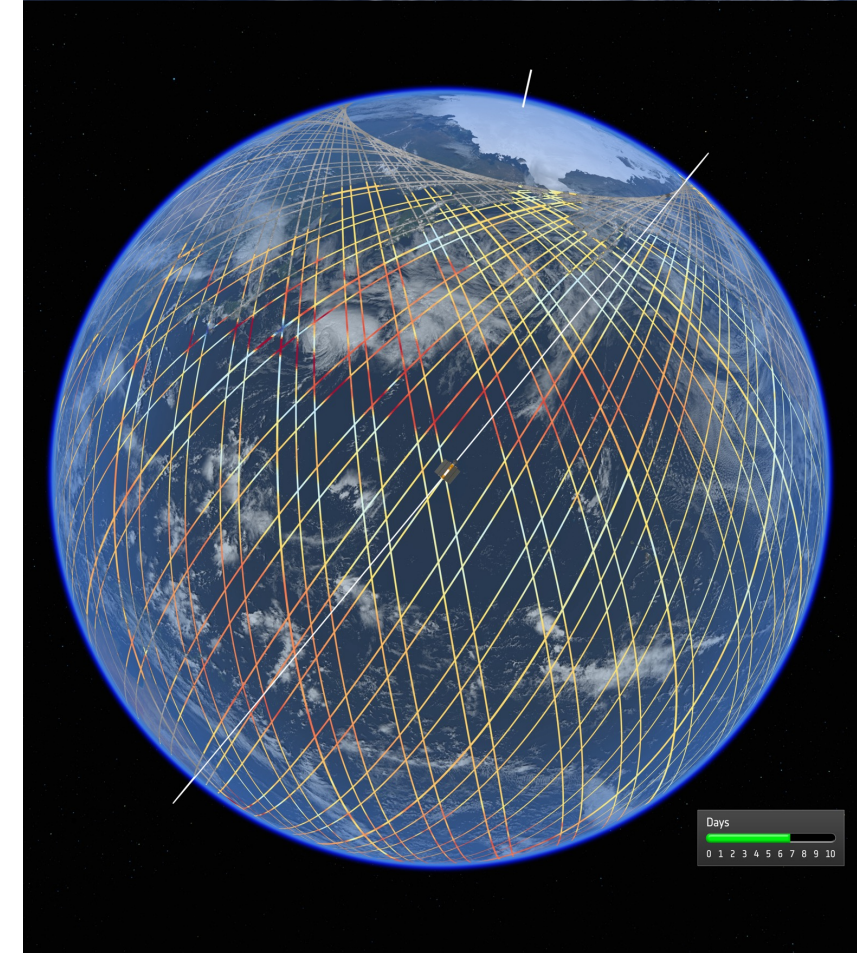
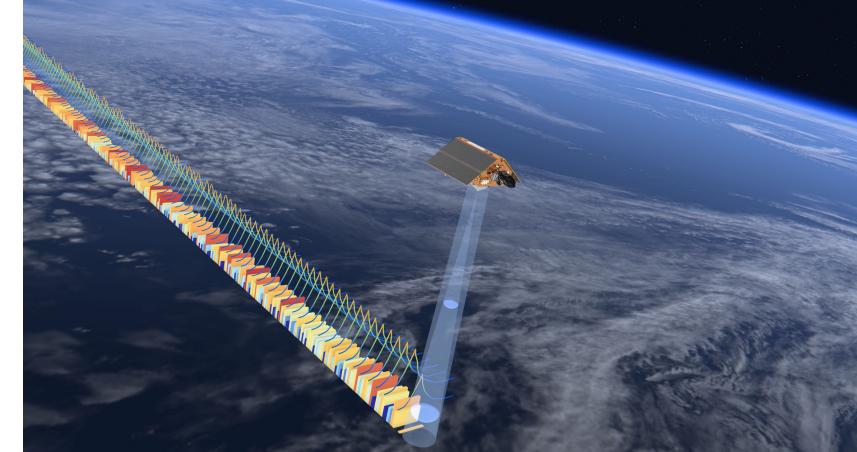
- Many applications require frequent observation throughout season (i.e. Mapping & change assessment)

## Spatial Resolution

- Higher details, shorter timeseries, higher costs

## Images are great, but ...≠ information

- generating products requires effort:
  - expertise in processing and dealing with large data amounts
- Validation and reliability
  - compare products against ground truth?
  - accuracy of products and methods (depending also on application)



# Other ideas

- Tourism industry (hotels, diving schools, ecotourism)
- Nature-based solutions for disaster resilience (mangroves, reefs, etc)
- Land-sea interactions (waste, pollution and nutrient run-off, sedimentation) for marine spatial planning, ridge-to-reef management, impact on policy dev
- Coastal debris detection, identification for clean-up and management
- Coral engineering (identification of location of resilient corals)
- Farming (fish, kelp, seagrass, solar and wind energy)
- Capacity building and local engagement (decolonization of science)
- Certification scheme for restoration projects
- Translating local knowledge to apps using participatory GIS

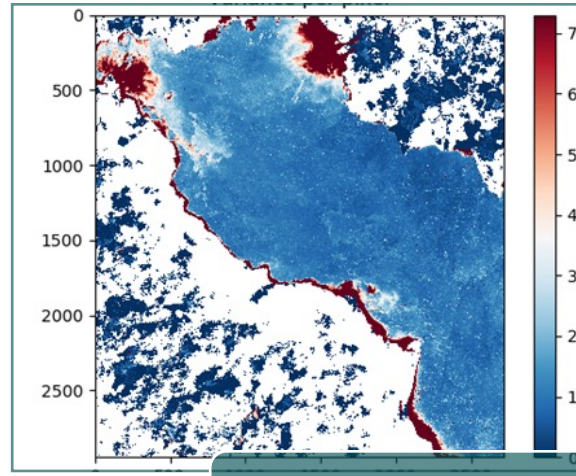




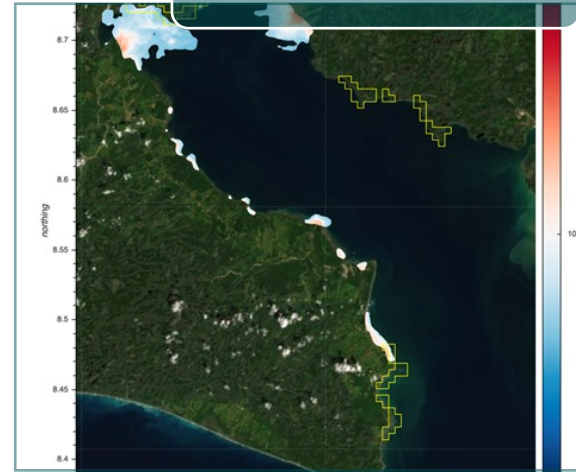
**Data Acquisition**



**Pre-processing**



**Data analysis**



**Values**

# Nemo

Monitoring and Early Warning System for Reef Management

## Water Quality Indicators

- Sedimentation (SPM)
- Chlorophyll Algae
- Sargassum (Macroalgae)
- Salinity
- Acidity

## Weather

- Rainfall
- Wind speed
- Sea surface temperature
- Solar intensity

## User-specific data

- Location of nurseries
- Location of existing plantation
- Location of planned plantation
- Below surface temperature

## Add data

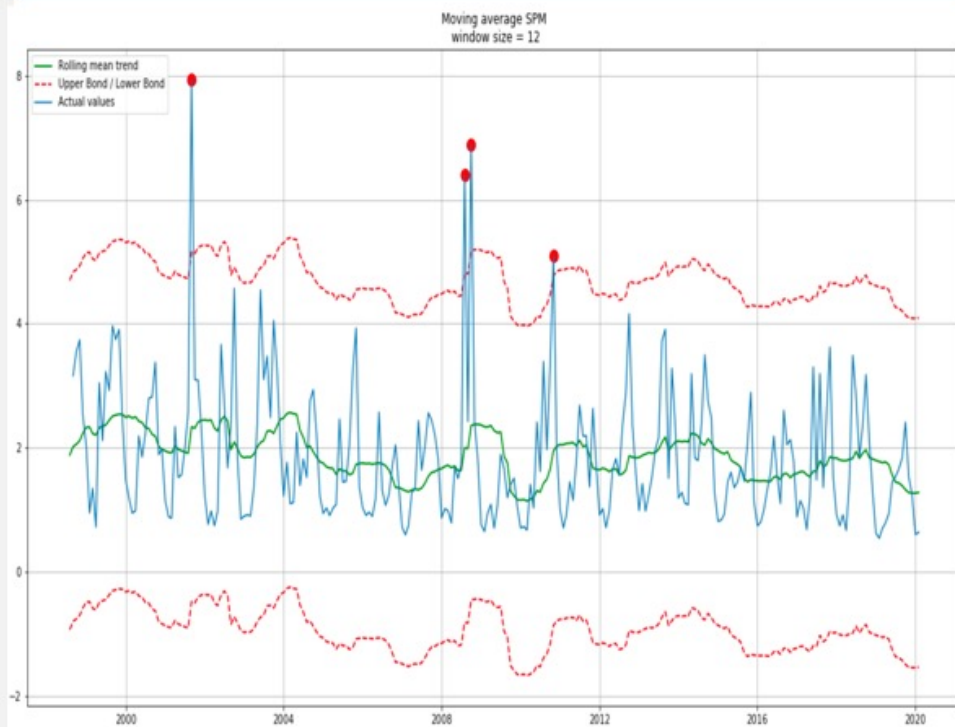
- Sensor recordings
- Photos; Comments

Select location  by name  by X, Y coordinate  draw polygon

Start date  End date



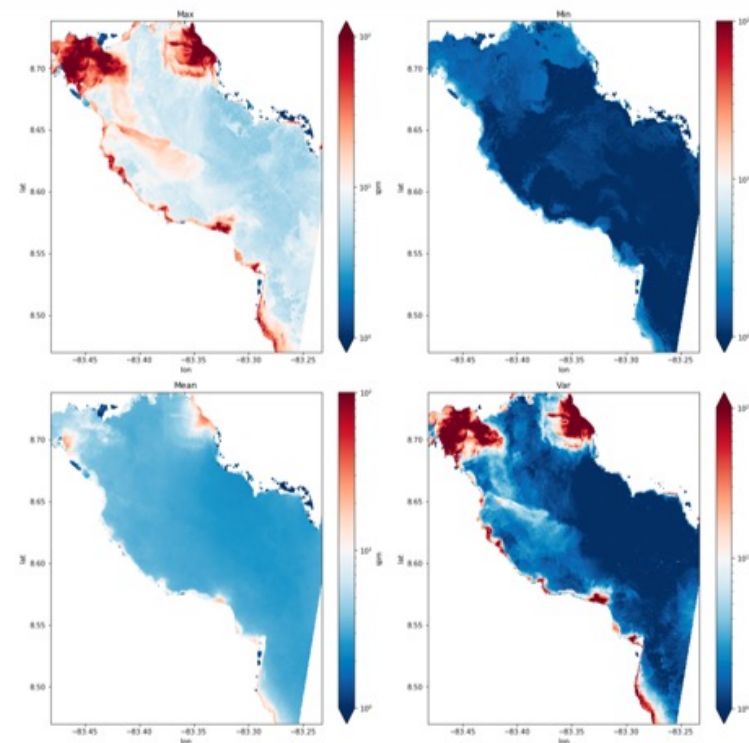
## Time series decomposition for the selected location



## Current Alert Status

Alert level: Normal  
Current value: Below alert level  
Length of time above alert levels: -

## Statistics aggregated per pixel over time



## Set New Alert

Parameter   
Value range condition   
Duration