

Applications of Remote sensing for Marine Spatial Planning in the Caribbean:

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Major challenges
Caribbean fisheries



Satellite remote sensing usage.

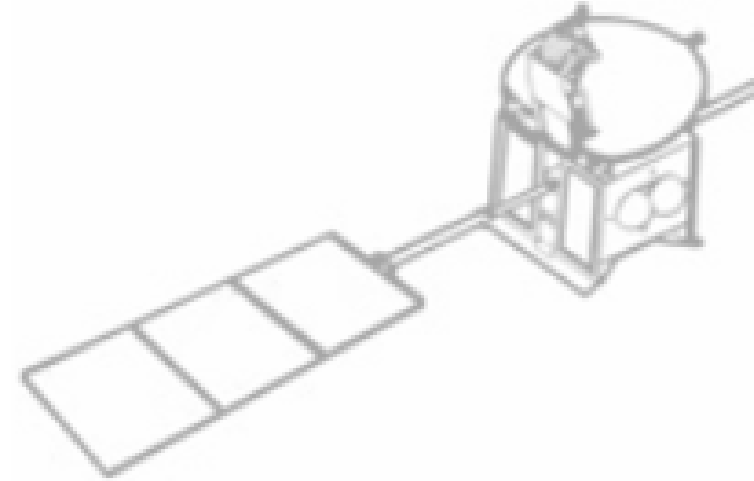


Case studies

- Bahamas: Coral baseline
- Guyana
 - Phytoplankton
 - Shoreline changes
- Trinidad-Oil spills
- Ship detection and security- Blue Justice
- Seagrass and seaweed monitoring




Closing remarks





Marine Planning in the Caribbean

- Major challenges
 - Caribbean fisheries
- 

Context

The United Nations Decade of Ocean Science will build a shared information system, based on trustworthy, scientific data, from all parts of the world's ocean. Professor Peter M. [Haugan](#) (2022) Chair of the Intergovernmental Oceanographic Commission of UNESCO

Satellite Remote Sensing is part of this trustworthy information and planning system for a resilient base ocean management framework. These tools can be used to meet parts of the requirements outlined by the Executive Director of CRFM (below)

Sustainable aquatic resources in the Caribbean requires Executive Director of the CRFM, Milton Haughton on Caribbean Fisheries Forum (April 23)

- Strengthen governance and management of the fisheries
- Profitable, sustainable fisheries and aquaculture industries.
- Thriving and resilient fishing communities.
- Healthy ecosystems and marine biodiversity and driven by the application of science, technology, innovation and entrepreneurship
- Accelerate development and implementation of the policy, legal and institutional reforms
- Investments to realize the full potential of marine and other aquatic resources for sustainable development.
- Provide adequate food, decent jobs, and a better quality of life for the region.

Why a UN Decade of Ocean Science

GLOBAL KNOWLEDGE GAPS

99%

of habitable marine areas lack basic biodiversity knowledge for their management



1 million

Approximate number of marine species that could still be unknown to science



3

Number of people who have explored the deepest known point of the ocean

Only 5%

of the ocean floor has been mapped at high resolution



103 million

Square miles of deep sea are in perpetual darkness



Major challenges



Very poor monitoring of recreational fisheries in the Caribbean (lack of statistics)



High amounts of illegal fisheries and dark vessels



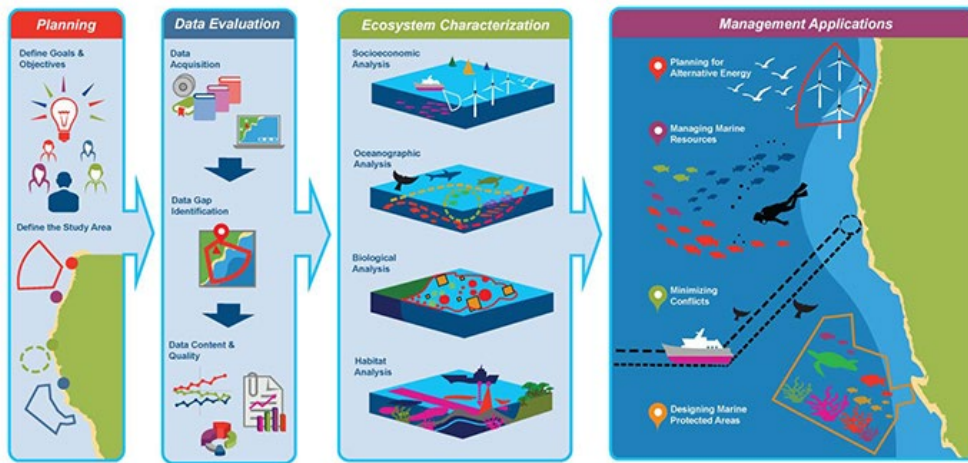
Conservation



Assuring food security

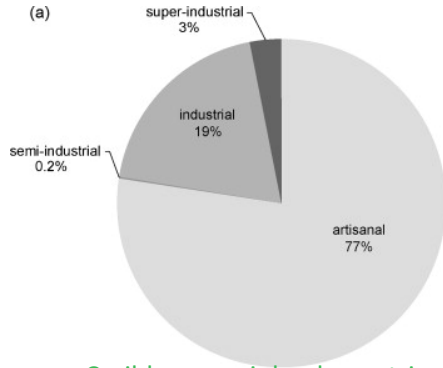
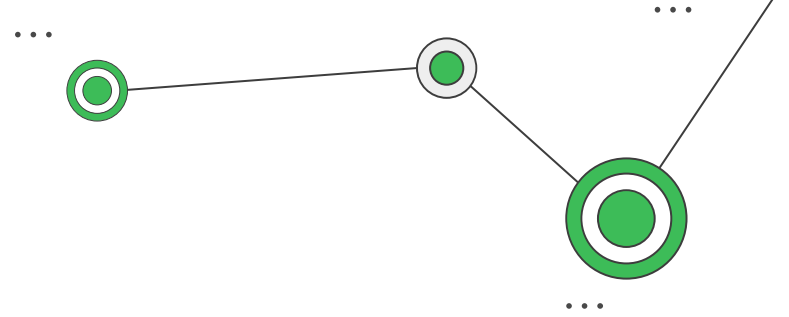


Offshore infrastructure

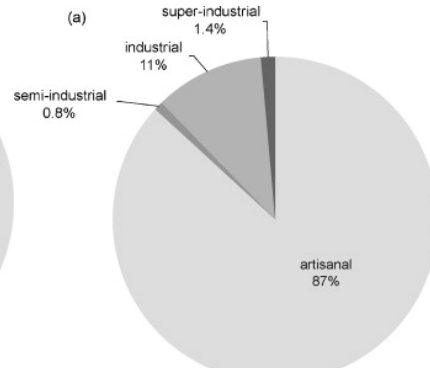


Source: Pacific Island Protected Area website

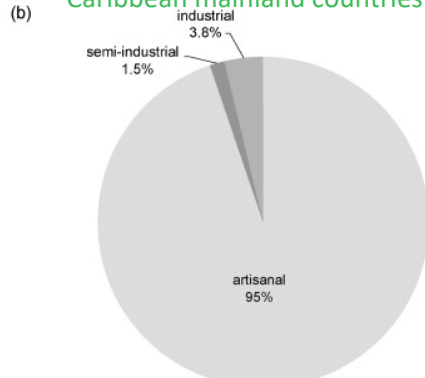
Fishing activities



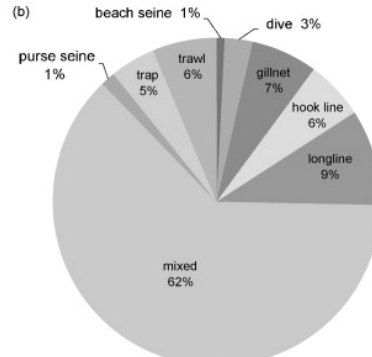
Caribbean mainland countries



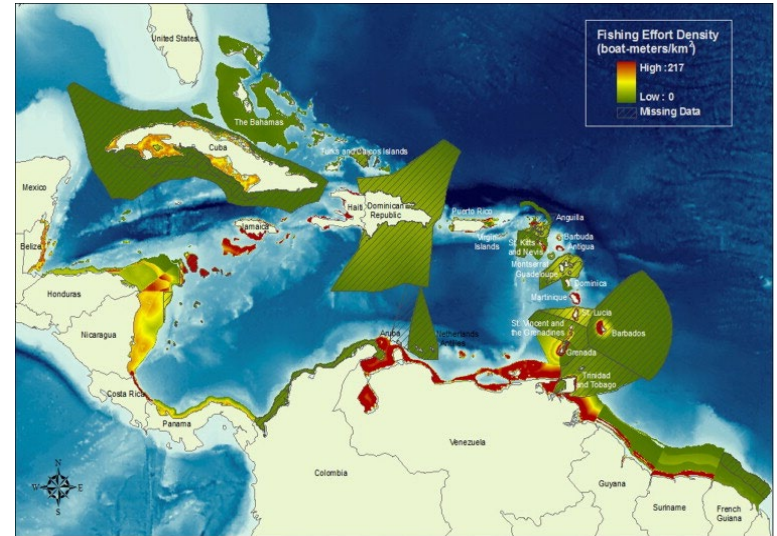
Boat-meters by development level



Caribbean island countries.



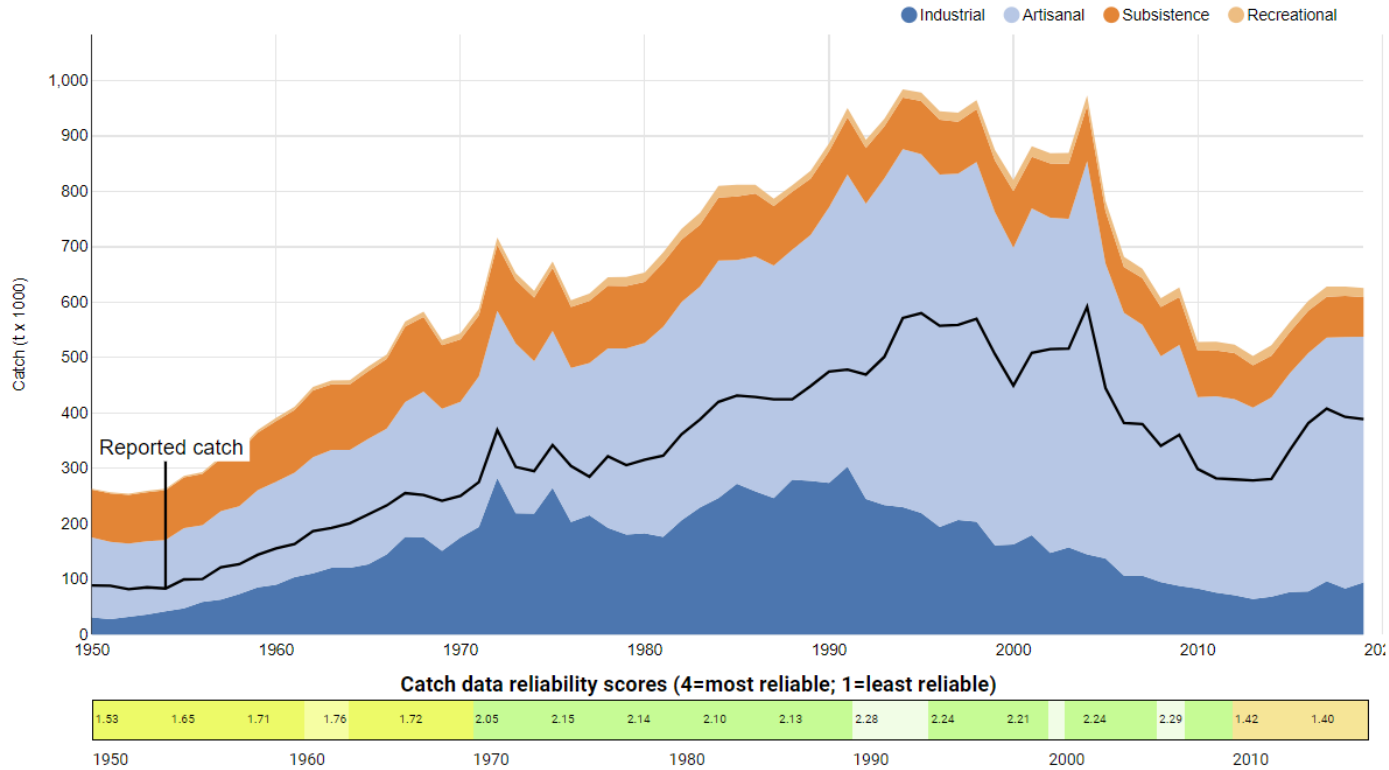
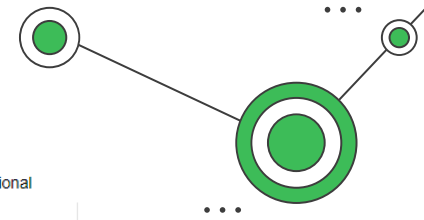
Boat-meters by gear type



Dunn, Daniel C., et al. 2010



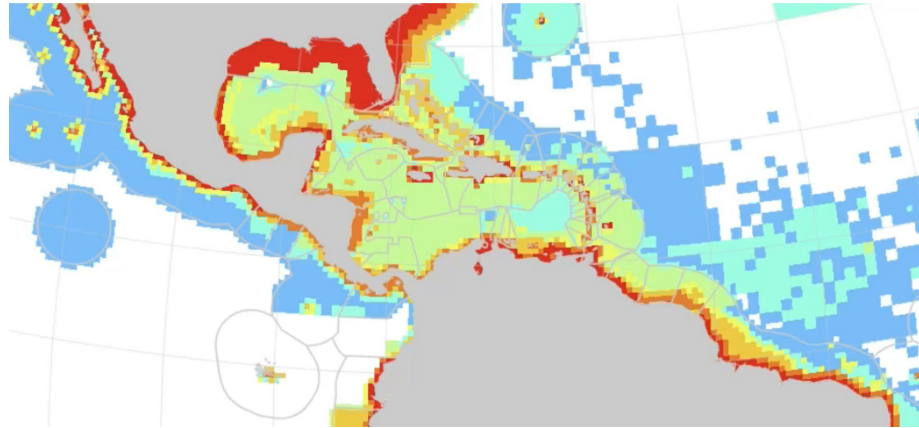
Fishing activities



Source: SeaAroundUs website



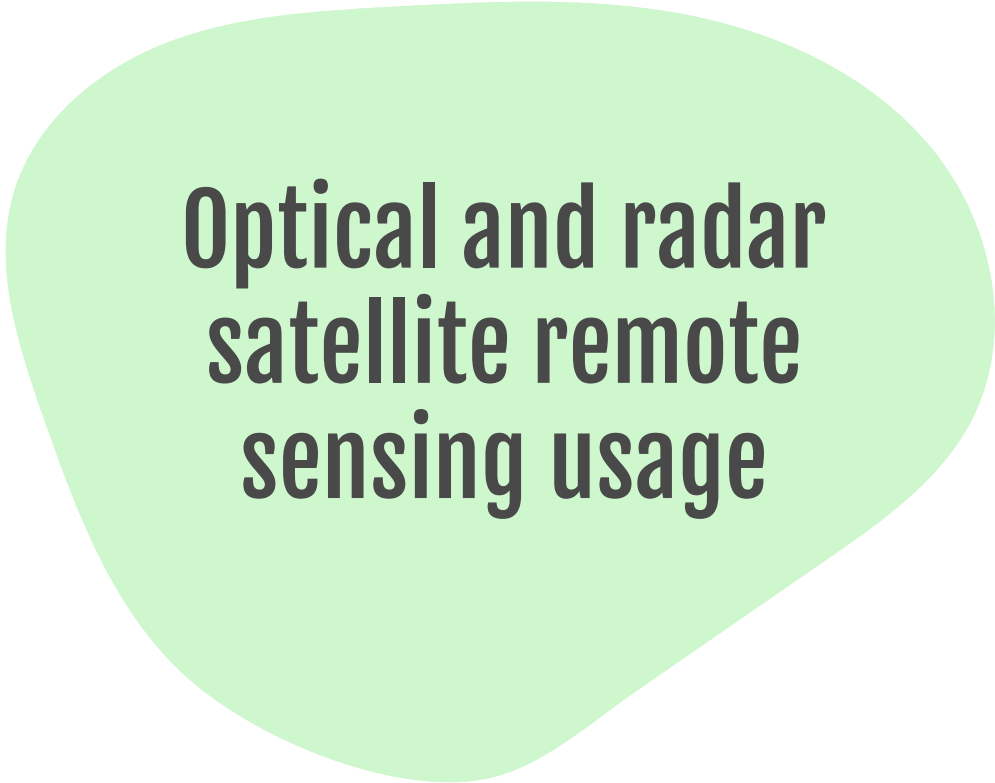

Fishing activities




Global fishing in 2019 (Total: 100,139 x 10³ t)

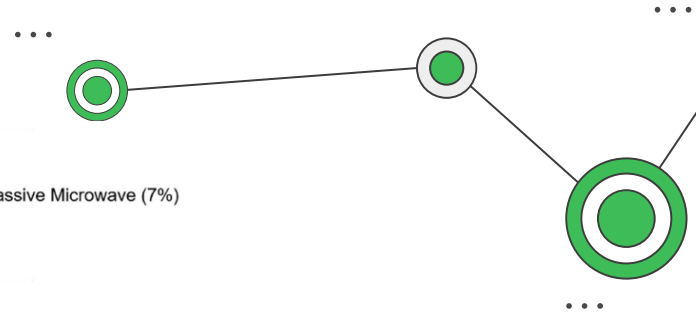
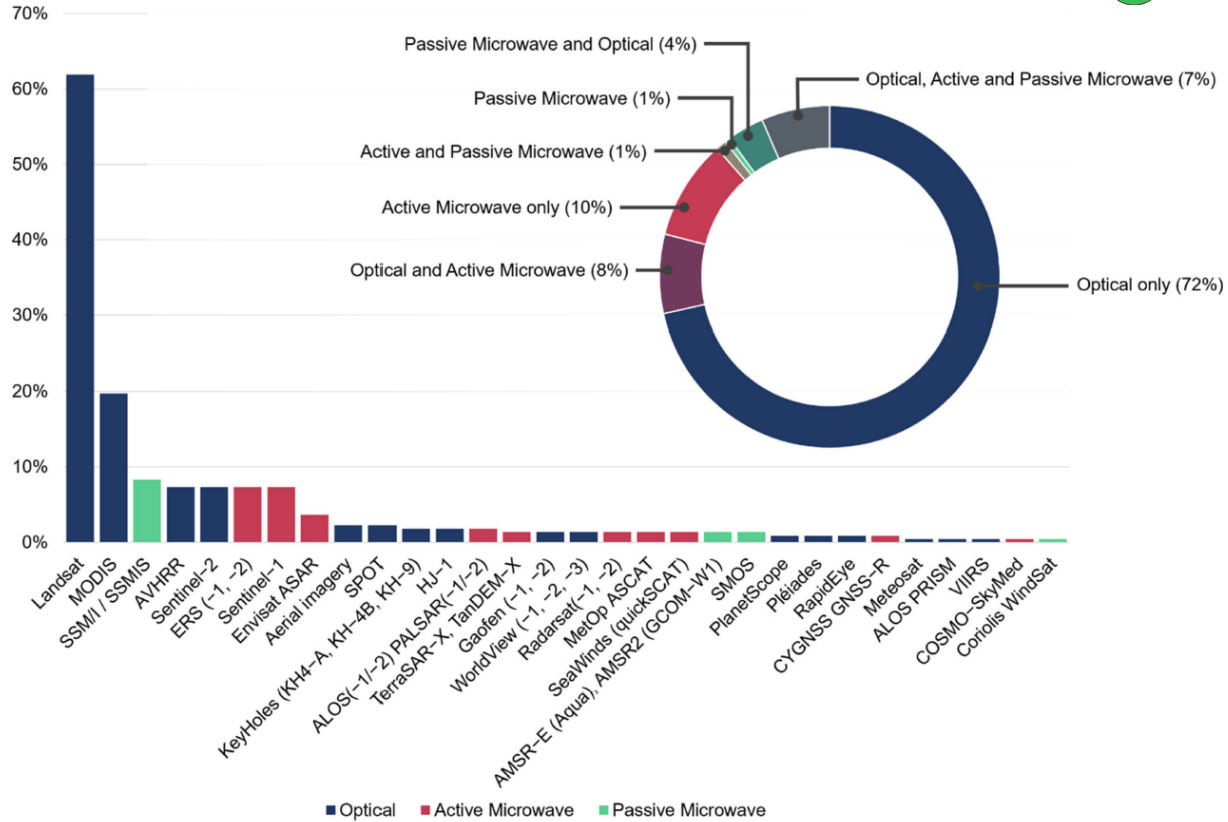


Source: SeaAroundUs website



Optical and radar satellite remote sensing usage





Sogno et al .Rem Sen. 2022, 14, 2475

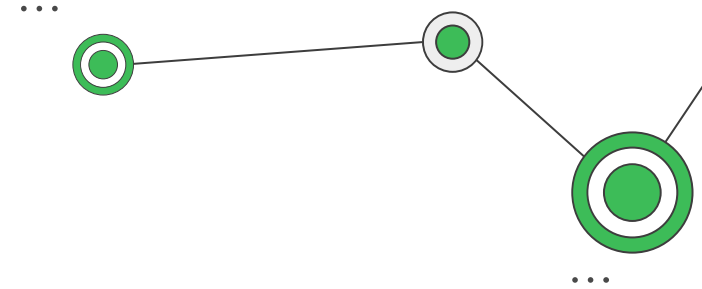
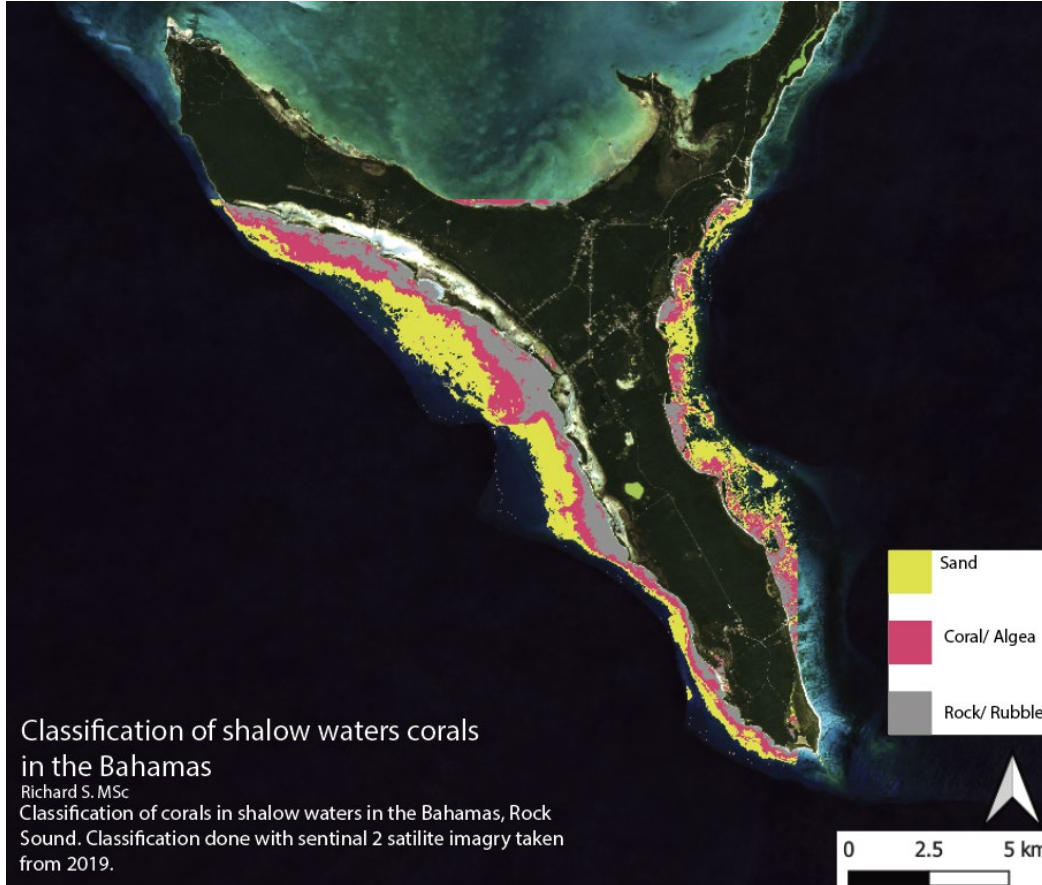
Figure 7. Used sensors (a) and sensor types (b) for surface water dynamics monitoring. Color coding indicates sensor type. Many studies use multiple sensors and sensor types.



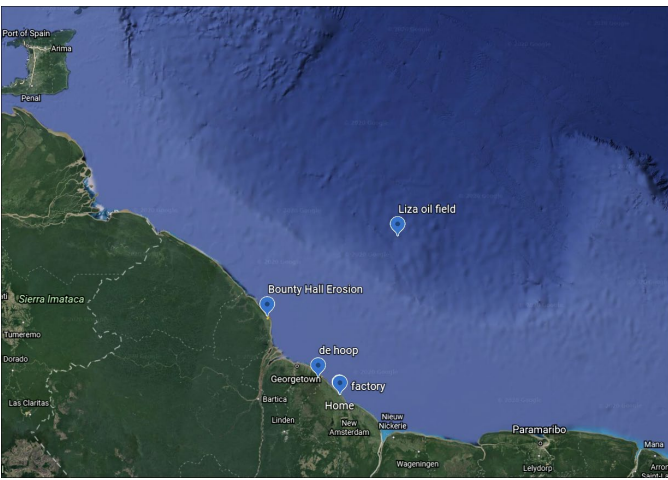
Case studies



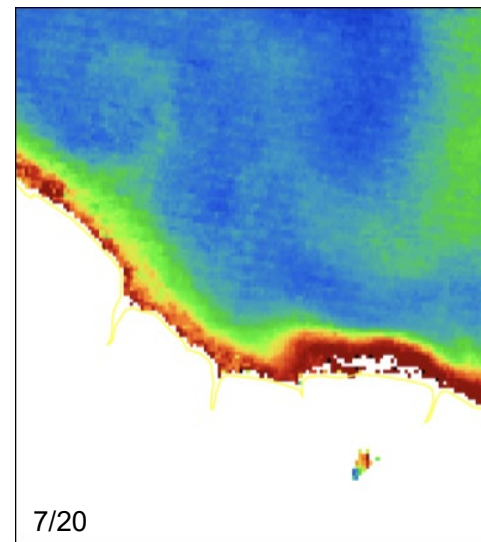
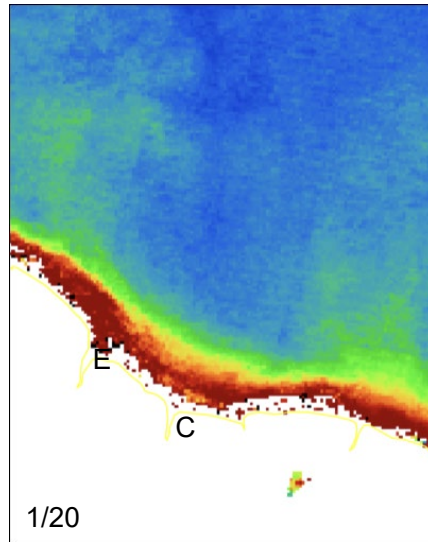
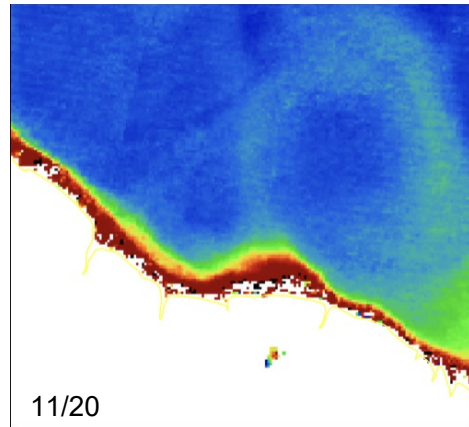
Coral classification in the Bahamas



- Classification of corals can help determine fish nurseries to help support local fisheries.
- Coral mapping can help with shoreline degradation strategies.



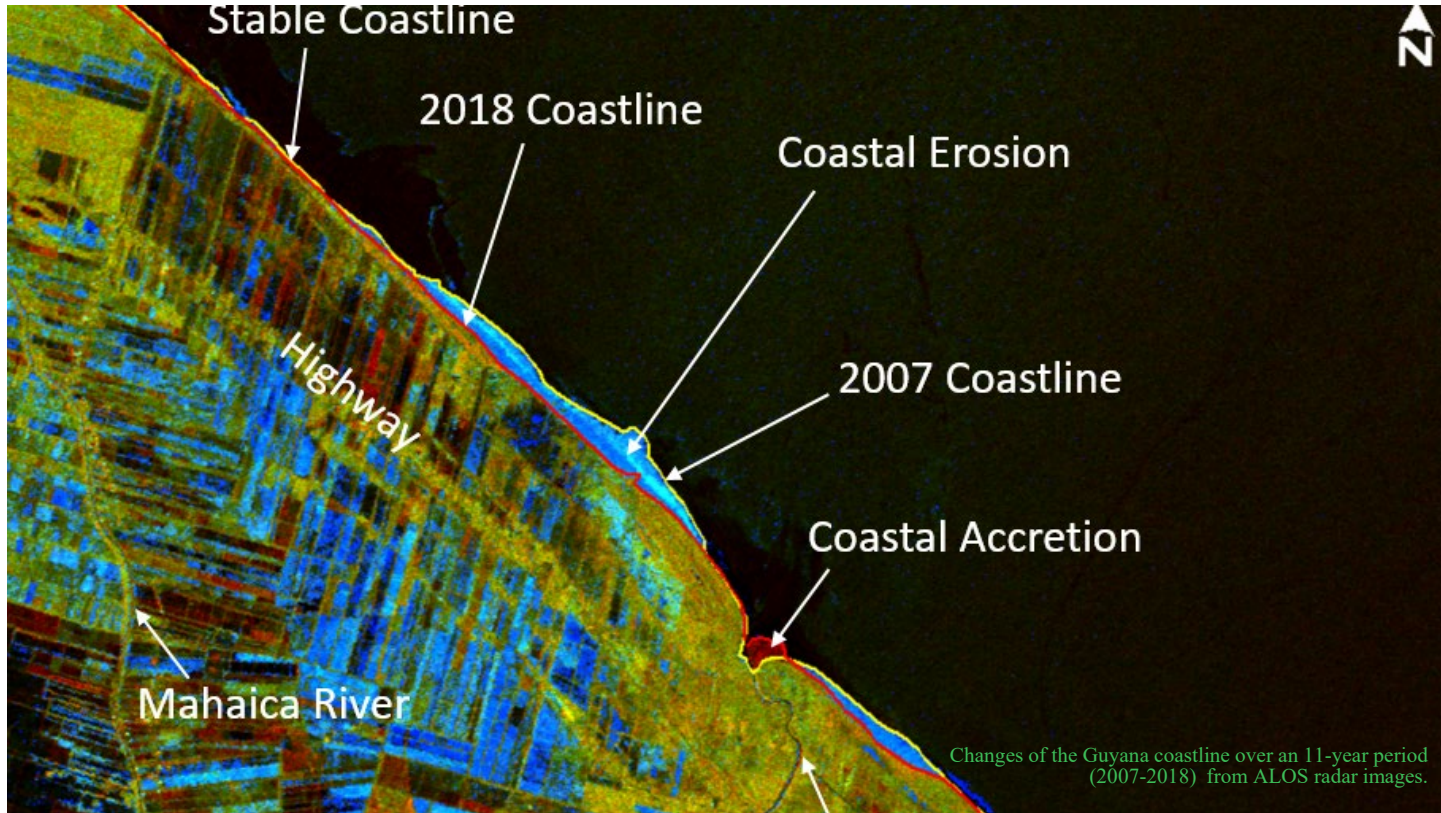
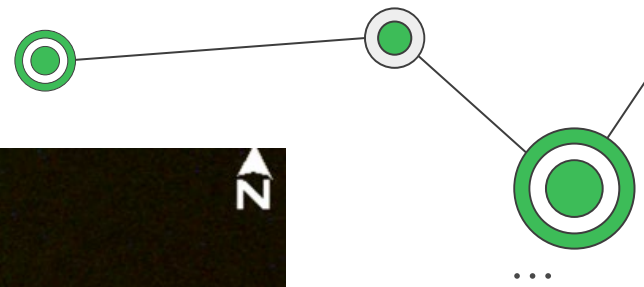
Chlorophyll distribution along the Guyanese coast



Seasonal and interannual cycles of ocean productivity using satellite ocean colour are linked to higher nutrients and the Caribbean fishery index

M.Jury, (2011) International Journal of Oceanography. doi:10.1155/2011/174729

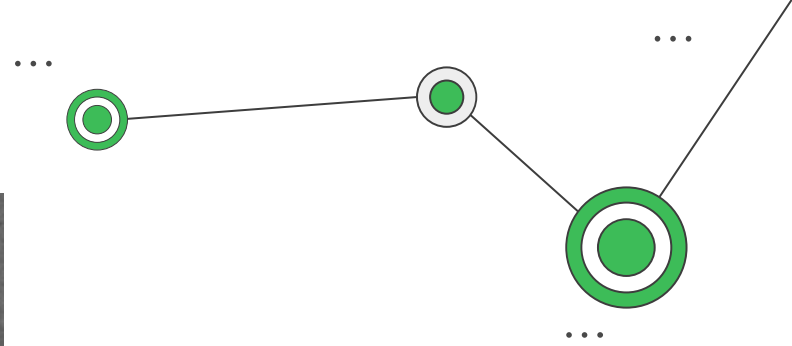
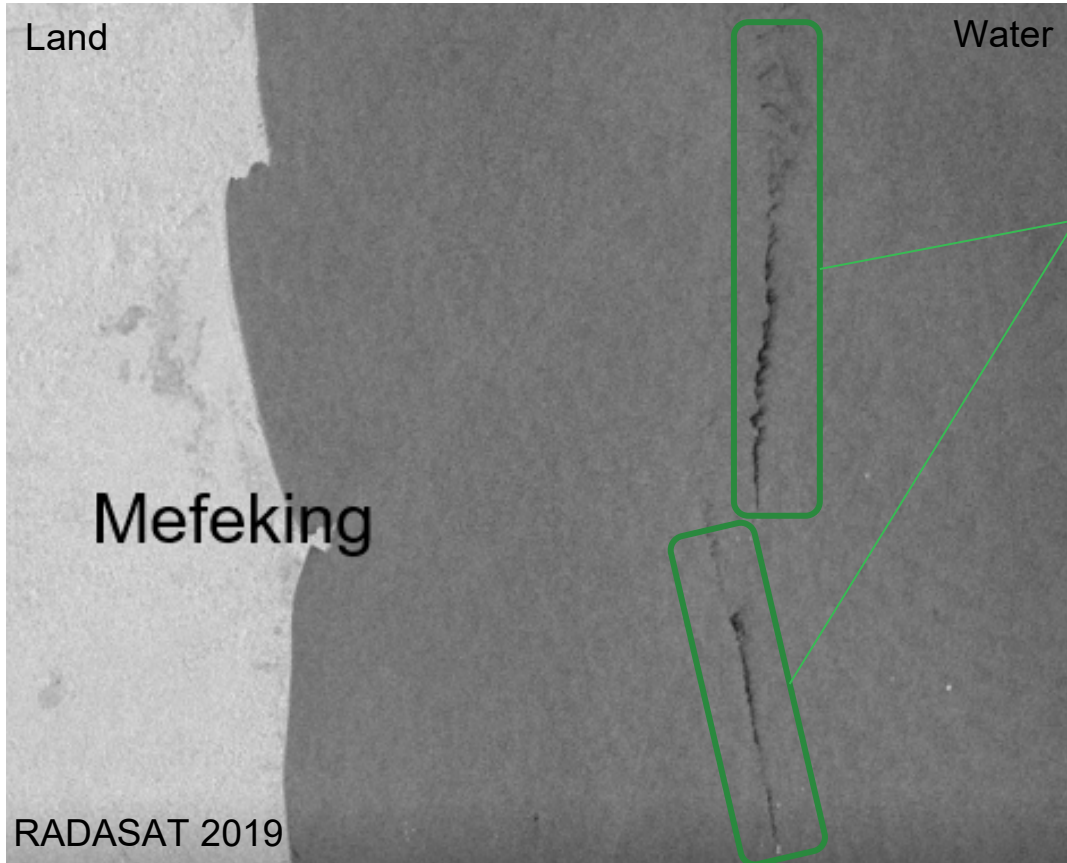
Shoreline changes over eleven years in Guyana



Why measure coastal erosion?

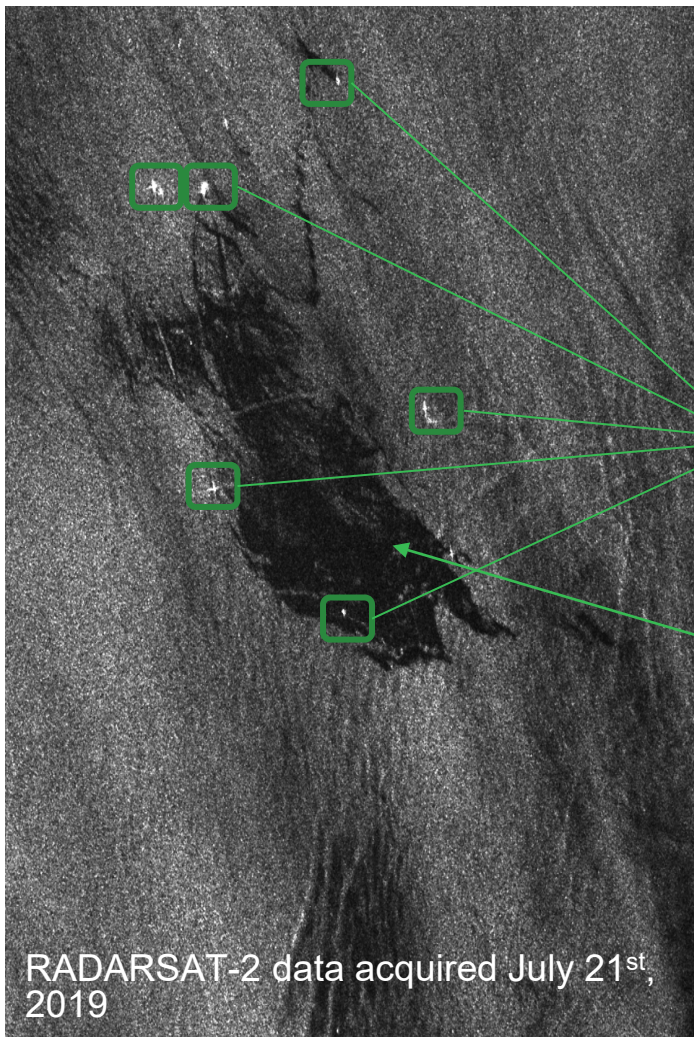
- Monitor threats to infrastructure
- Measure land loss rates
- Planning mangrove restoration projects

Detection of oil spills in offshore Trinidad



- An oil spill in was observed from nighttime satellite radar images.

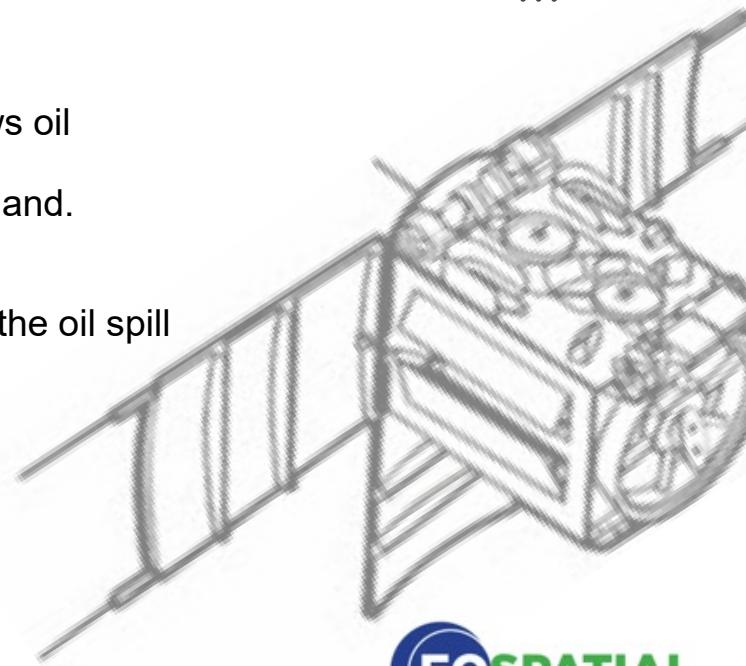


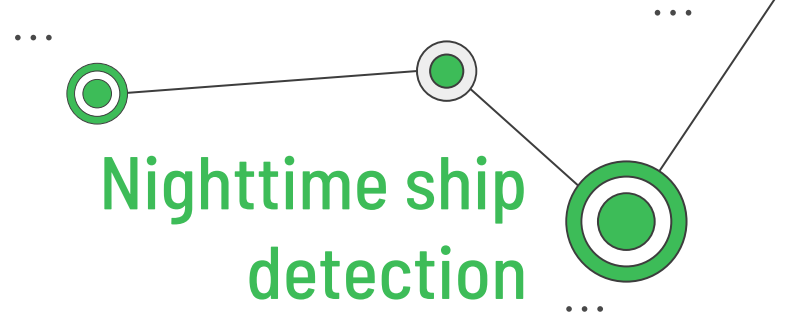
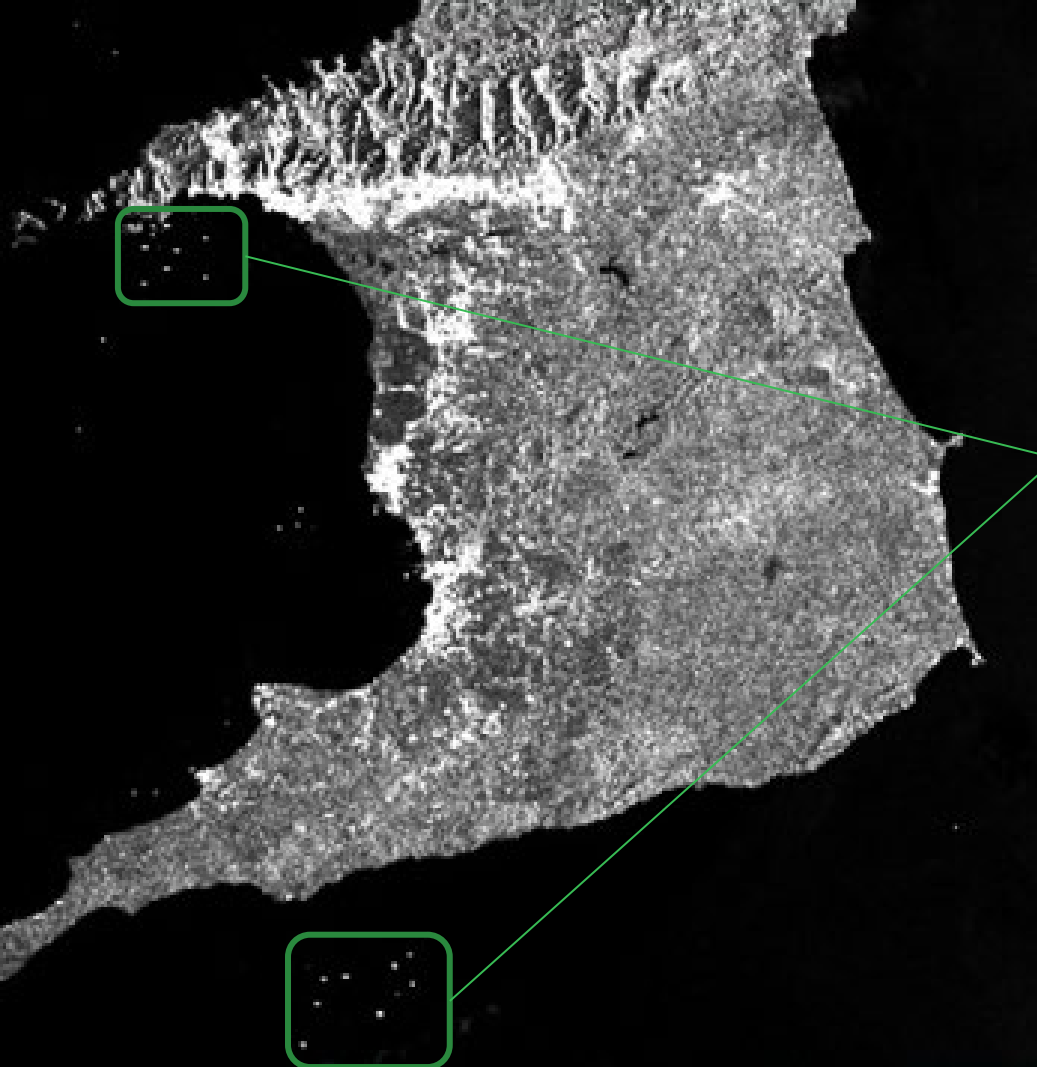


Detection of oil spills from RADARSAT

• Bright dots shows oil platform and ships offshore Newfoundland.

• Black area shows the oil spill





Nighttime ship detection

- Bright spots in the ocean are ships.
- Ships with AIS (Automated Identification System) are registered, and others may be considered “dark vessels”
- Can be used to support Caribbean Blue Justice programs

Seagrass classification in Zanzibar

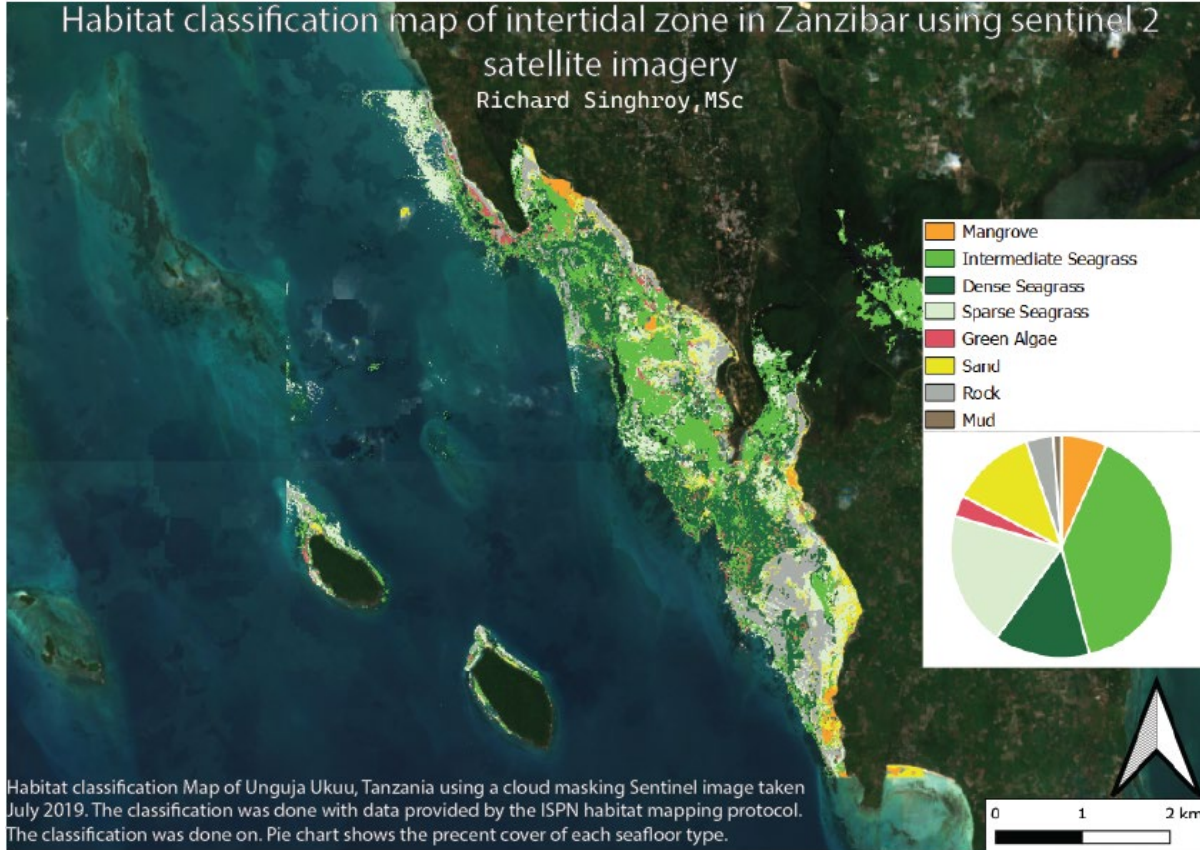
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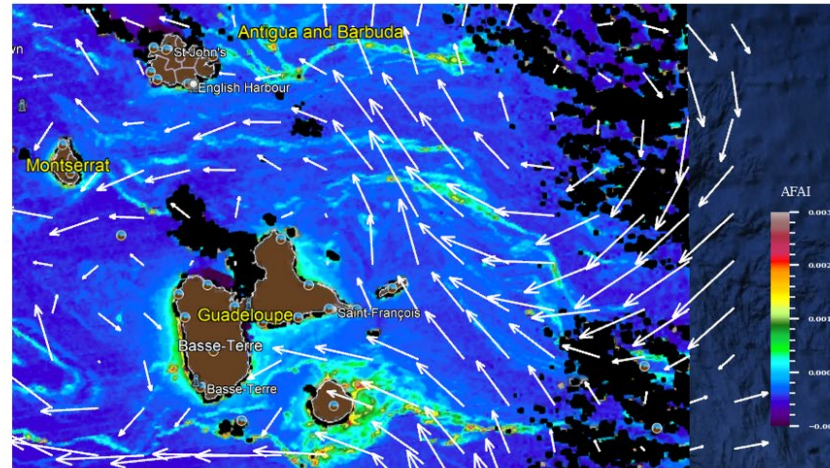
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- Classification maps are being used to inform policy on the uses of coastal resources

Sargassum

10-4-23
Warmer temp

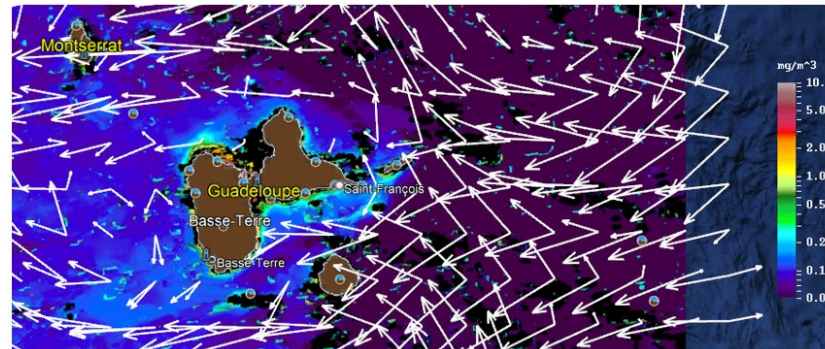


Regional seasonal distribution of Sargassum near Guadeloupe and its linkages to temperature variability

2-2-23
Cooler Temp

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Florida

(AFAI)- Alternative
floating algae index
algorithm developed for
the MODIS satellite
images



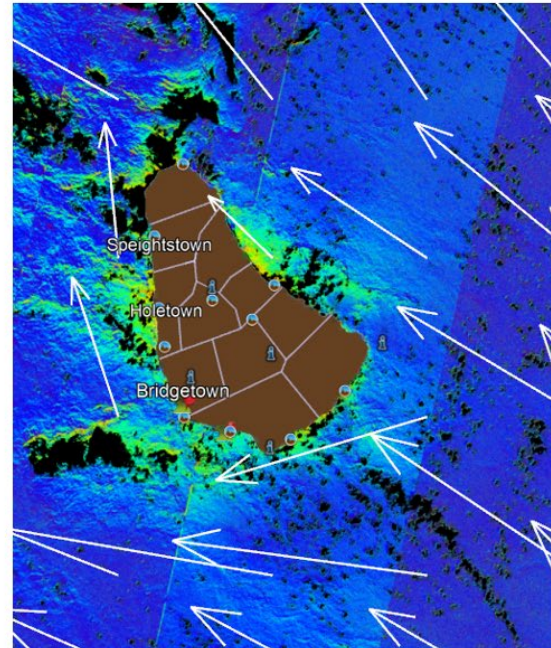
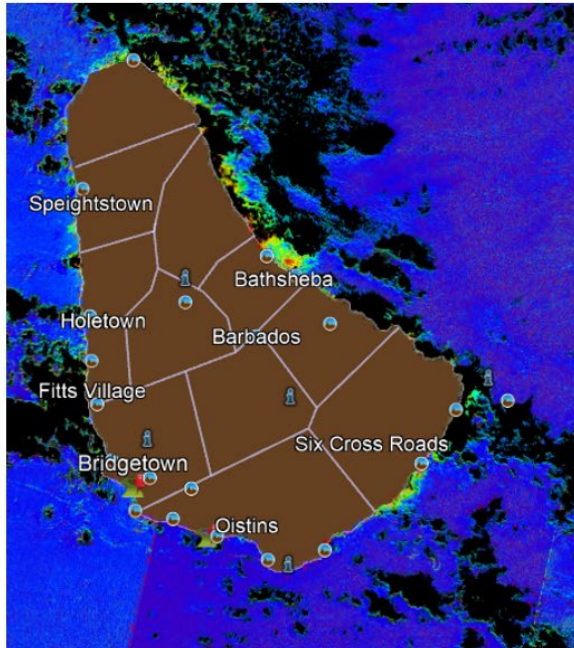
Sargassum

Sargassum – Barbados showing seasonal distribution

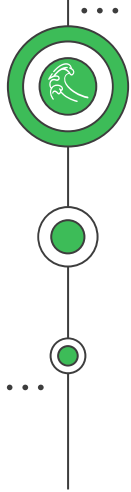
Observed from Sentinel 2 Optical images

6-02-22

30-09-22

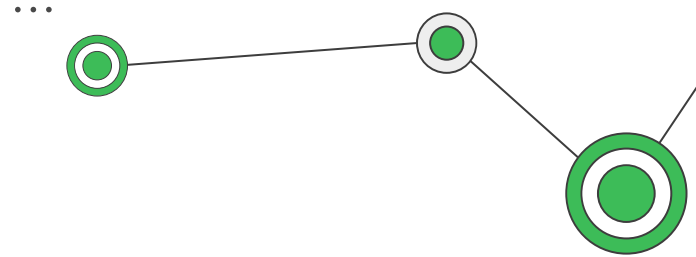
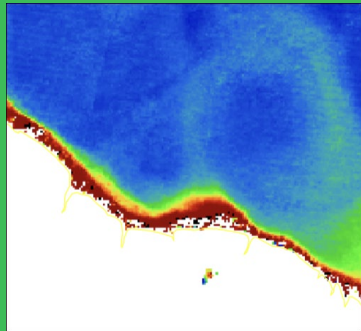
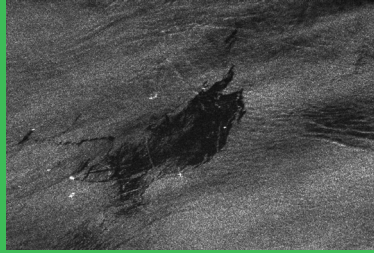


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Conclusion





Oil spills and ships can be detected with satellite radar allowing for improved monitoring and higher accountability.

Optical satellite image classification is a viable method for characterizing seaweed, intertidal and shallow ecosystems for management.

Optical and radar satellite can be used to monitor shoreline degradation and water conditions to measure the impact of climate change



Thank you
Any questions