

Improving the knowledge of our oceans and seas and bringing them closer to citizens

Blue-Cloud, AANChOR, AORAC-SA | AtlantOS program

Facing the Sargassum problem in the Mexican Caribbean through satellite and economic data analysis

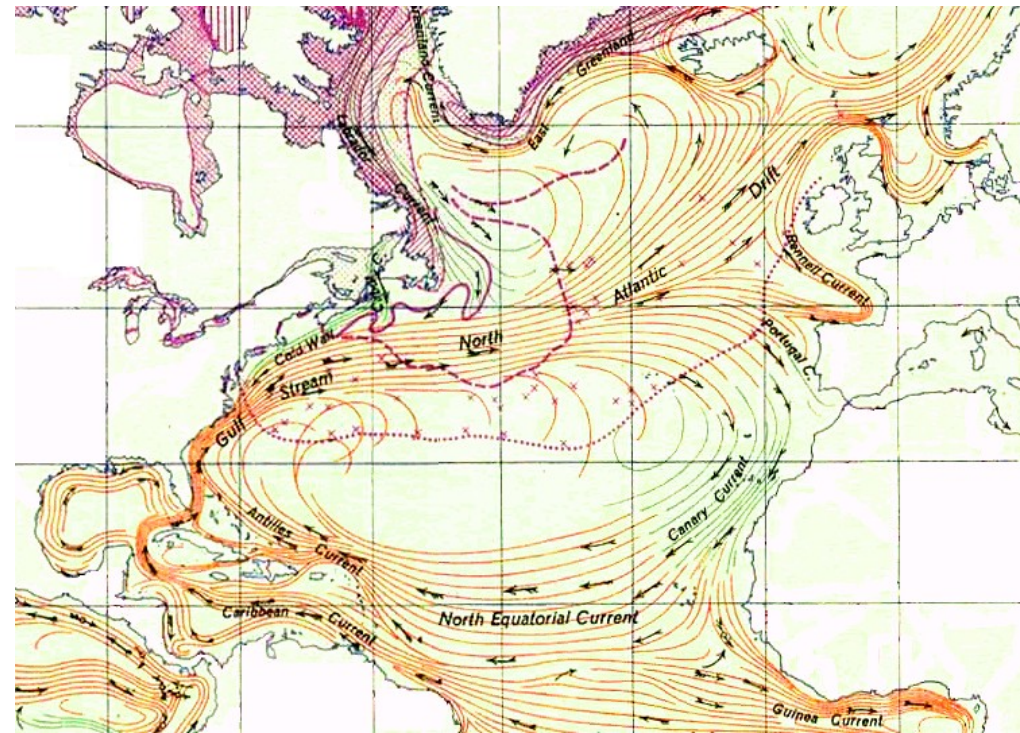
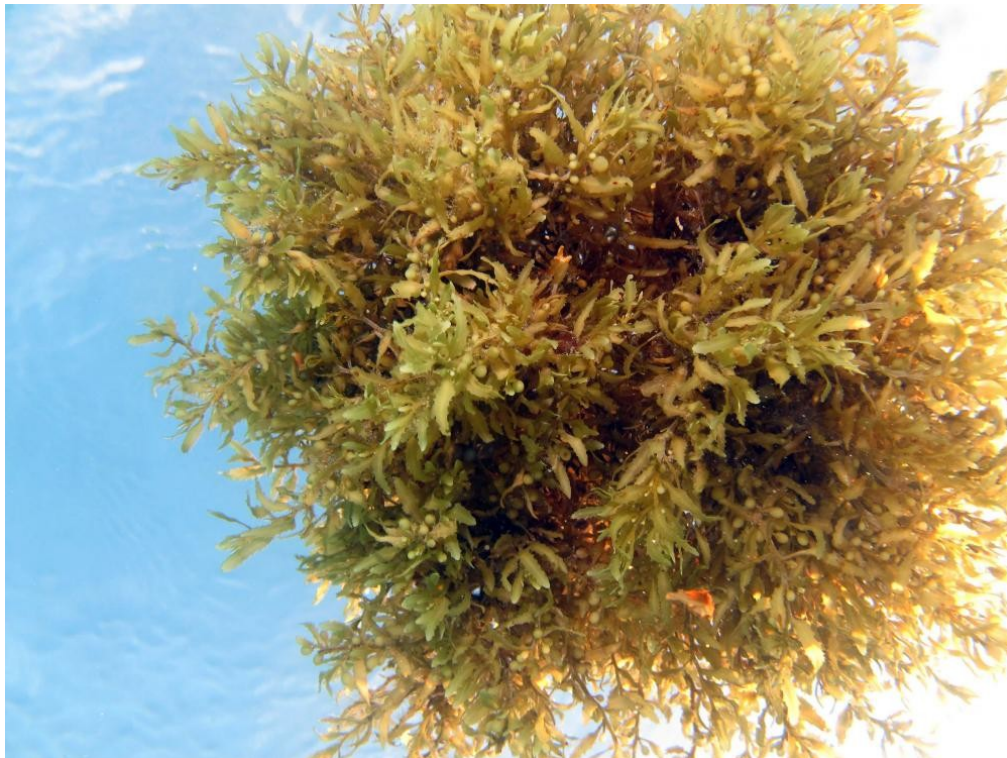
Juan Claudio Toledo Roy

Researcher at National Autonomous University of Mexico UNAM
Member of winning team of Ocean Hackaton 2019

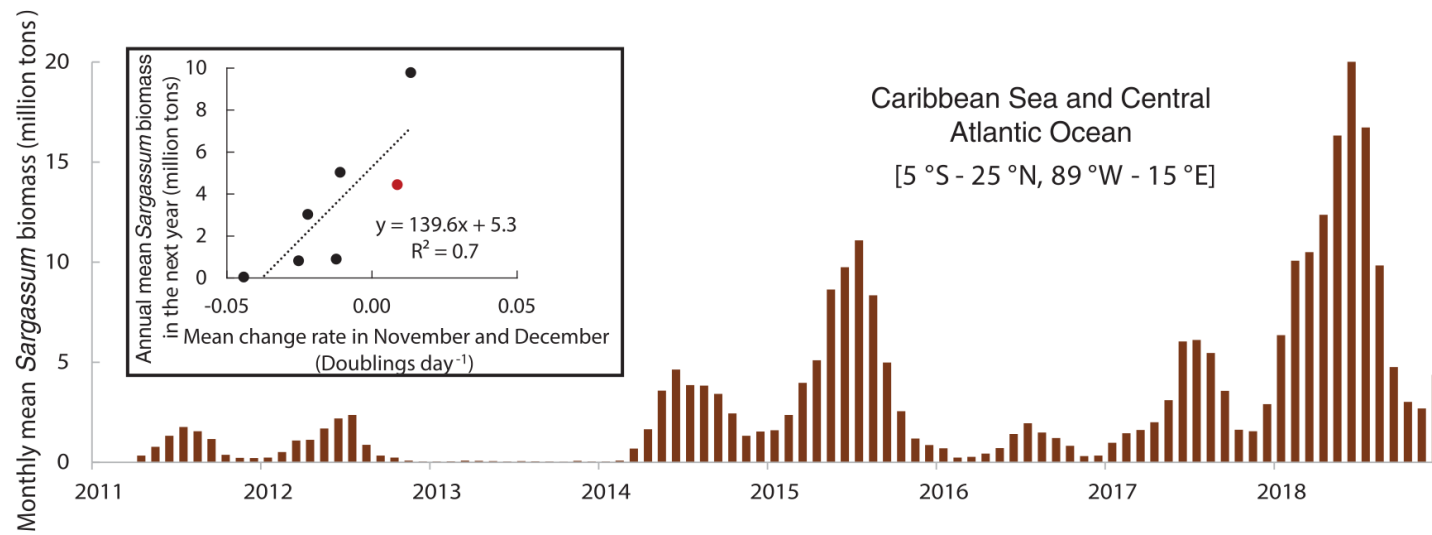
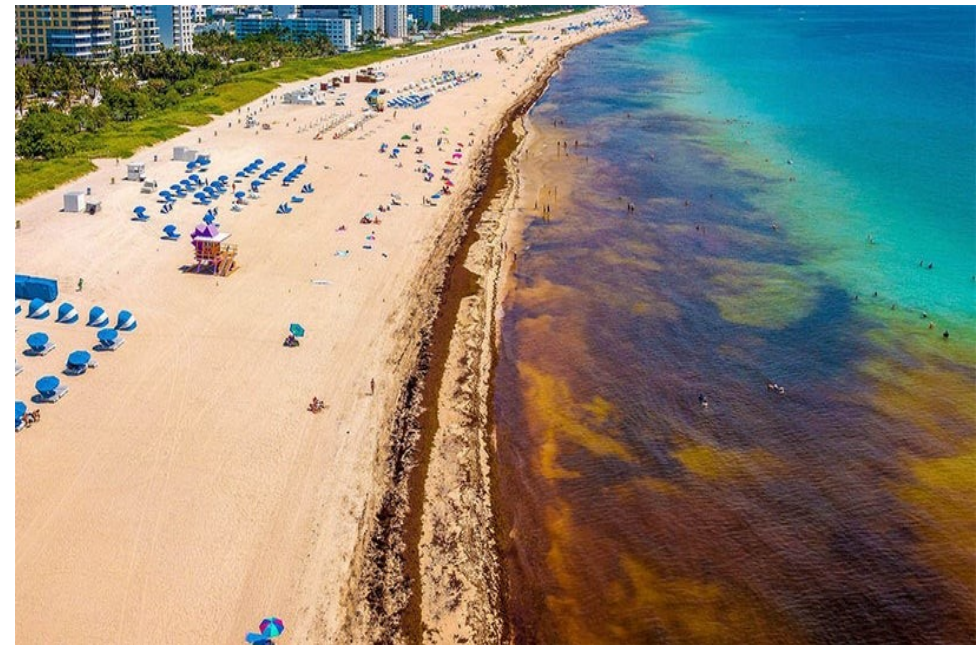
5 February 2020 – Brussels, Belgium

Sargassum

- A genus of brown macroalgae
- Photosynthetic, free-floating & pelagic (open ocean)
- Known since Portuguese explorers reported it in XV century



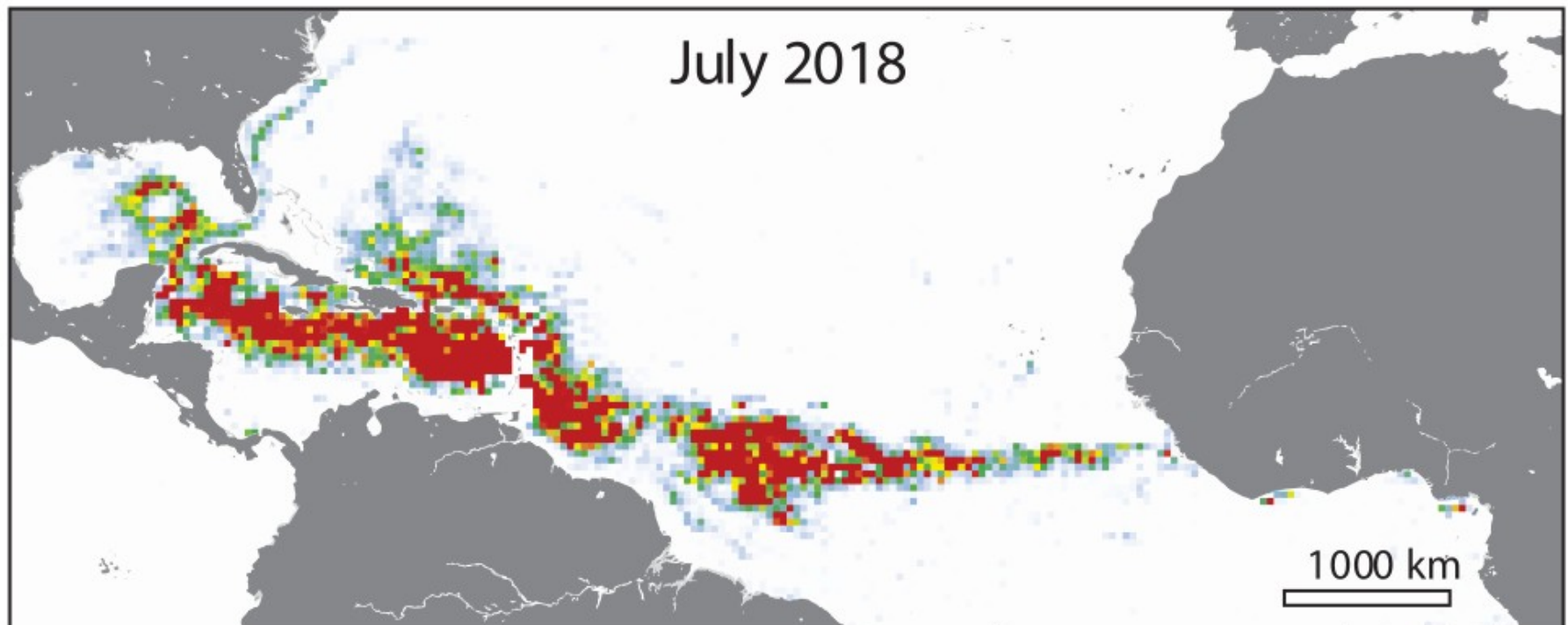
Massive beachings of Sargassum along Caribbean coasts since 2014



Wang et al.
(2019)

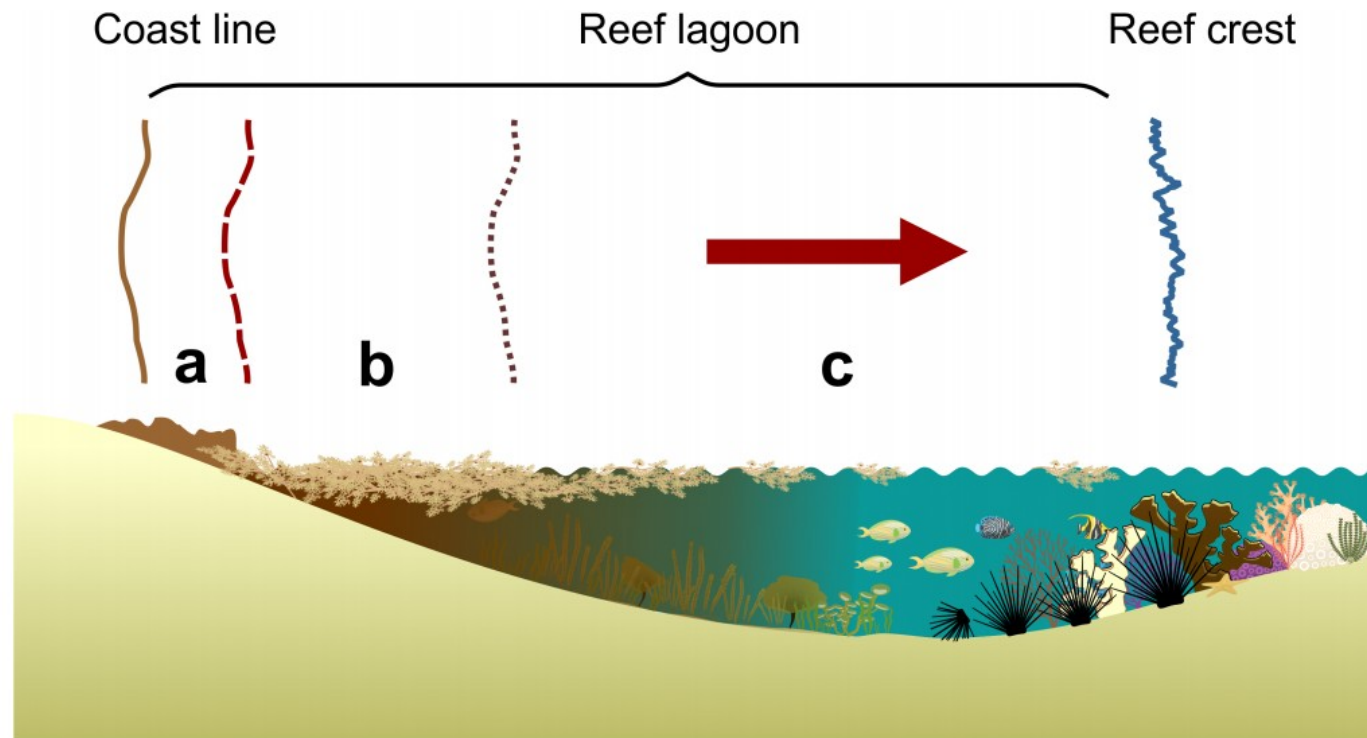
Causes of recent blooms not understood

- Tropical Atlantic and Caribbean; unrelated to Sargassum sea
- Could be caused by sea temperature changes (climate change)
- Linked to agrochemicals discharged by the Amazon
- Dust from Sahara, upwellings in West Africa



Ecological impacts

- Seaweed decomposition liberates acids, ammonia, metals
- Mats block light, damage to seagrasses
- Contributes to choral bleaching
- Beach erosion



Cabanillas-Terán et al. PeerJ (2019)

Economic impacts

- Serious problem for touristic sector
- Also affects fishing



May 2019

Facing the problem 1. Economic analysis

- Finding economic uses for algae collected on beaches and at sea
- May help offset the costs of collection, boost local economies
- Government grant with **Dr. Jorge Cantó** and **University of Quintana Roo**



Possible **economic uses** of Sargassum algae

Alginates

- Industries: food, textile pharmaceutical, etc.



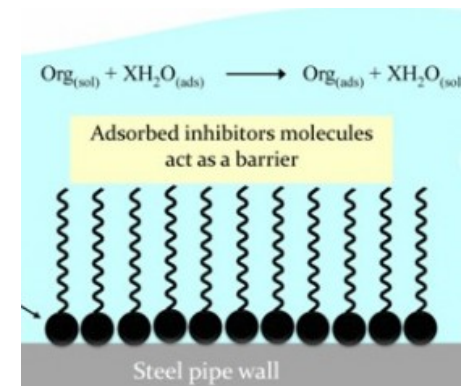
Bagasses

- Agriculture, paper
- Animal feed



Oils

- Biodiesel
- Corrosion inhibitors



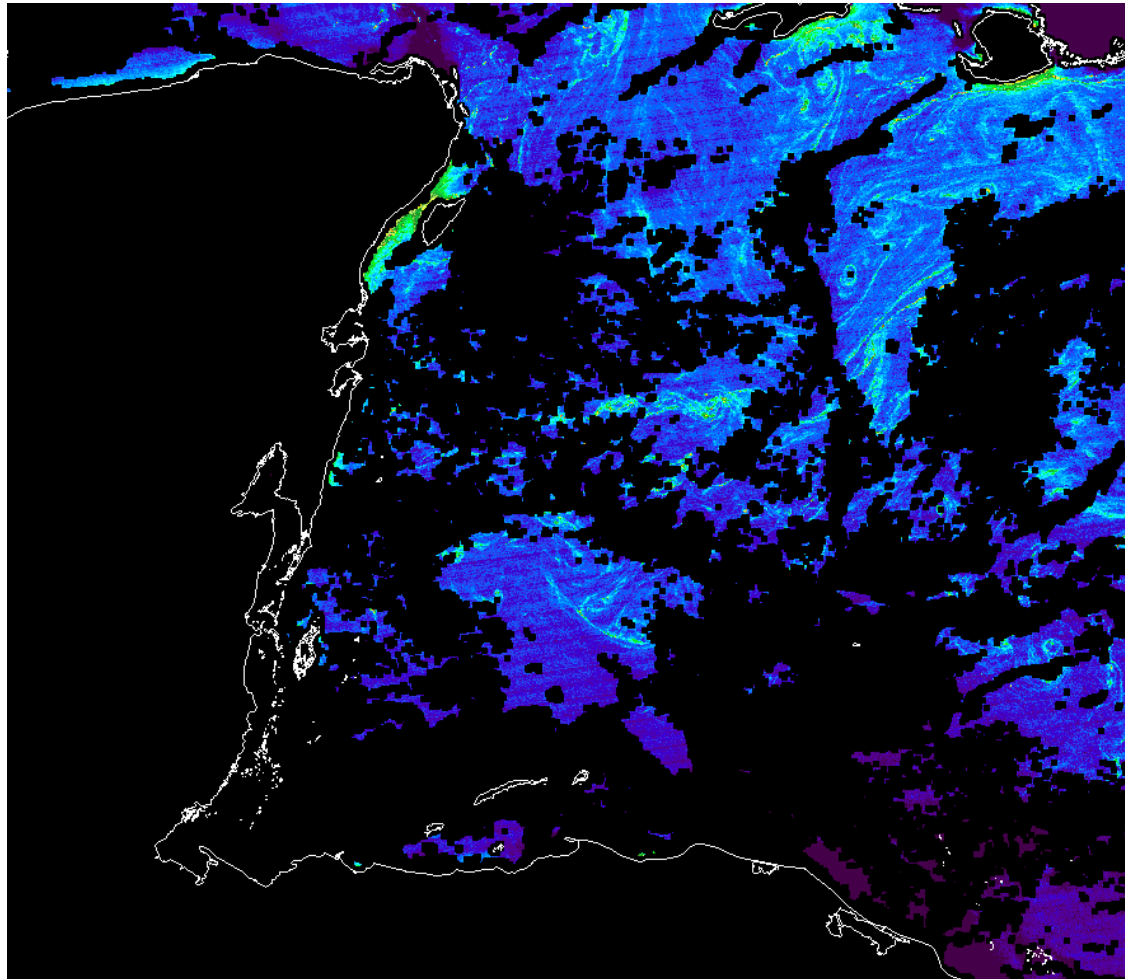
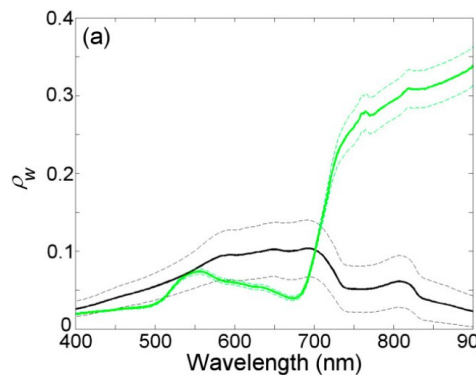
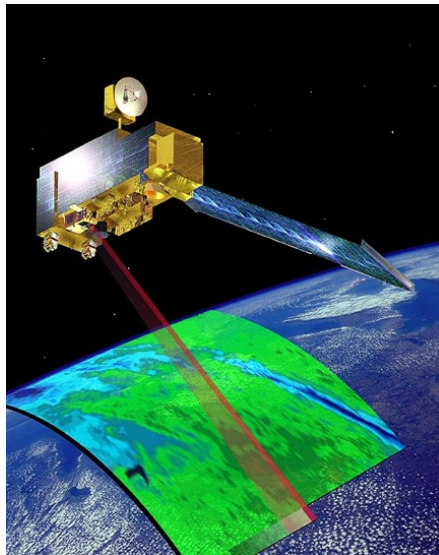
Evaluating and comparing the options

- Multiple dimensions: economic, ecologic, social, technical, etc.

Aplicación	Descripción	Ponderación							
		Desarrollo por tipo de alga	Social	Técnica	Financiera	Institucional	Ambiental	Mercado	Total
Analgésicos	Obtención de compuestos capaces de suprimir o aliviar la sensación dolorosa	0	5	2	1	5	5	5	23
Antinflamatorios	Obtención de productos capaces de disminuir tanto el dolor como la inflamación.	5	5	2	1	5	5	5	28
Alimento de animales	Generación de complemento alimenticio para ganado.	0	3	2	1	5	5	5	21
Alginatos	Obtención de alginatos mediante la degradación fraccionada del alga, frecuentemente en la industria de la alimentación como espesantes y emulsionantes.	5	3	5	5	5	5	5	33
Insecticida	Obtención de insecticida que ha sido probado eficiente para el control del mosquito Anopheles sundaicus, principal transmisor de la malaria.	0	3	2	1	5	5	5	21
Biochar	Biochar o biocarbón se obtiene de los restos vegetales y residuos de biomasa, con la capacidad de ser aplicado al suelo para mejorar sus propiedades además se está investigando como una forma de secuestrar carbono para reducir las emisiones de dióxido de carbono.	0	3	2	1	5	5	3	19
Surfactantes	Uso potencial de los surfactantes para remediar suelos contaminados con hidrocarburos.	5	5	5	5	5	5	5	35

Facing the problem 2. Satellite detection and forecast

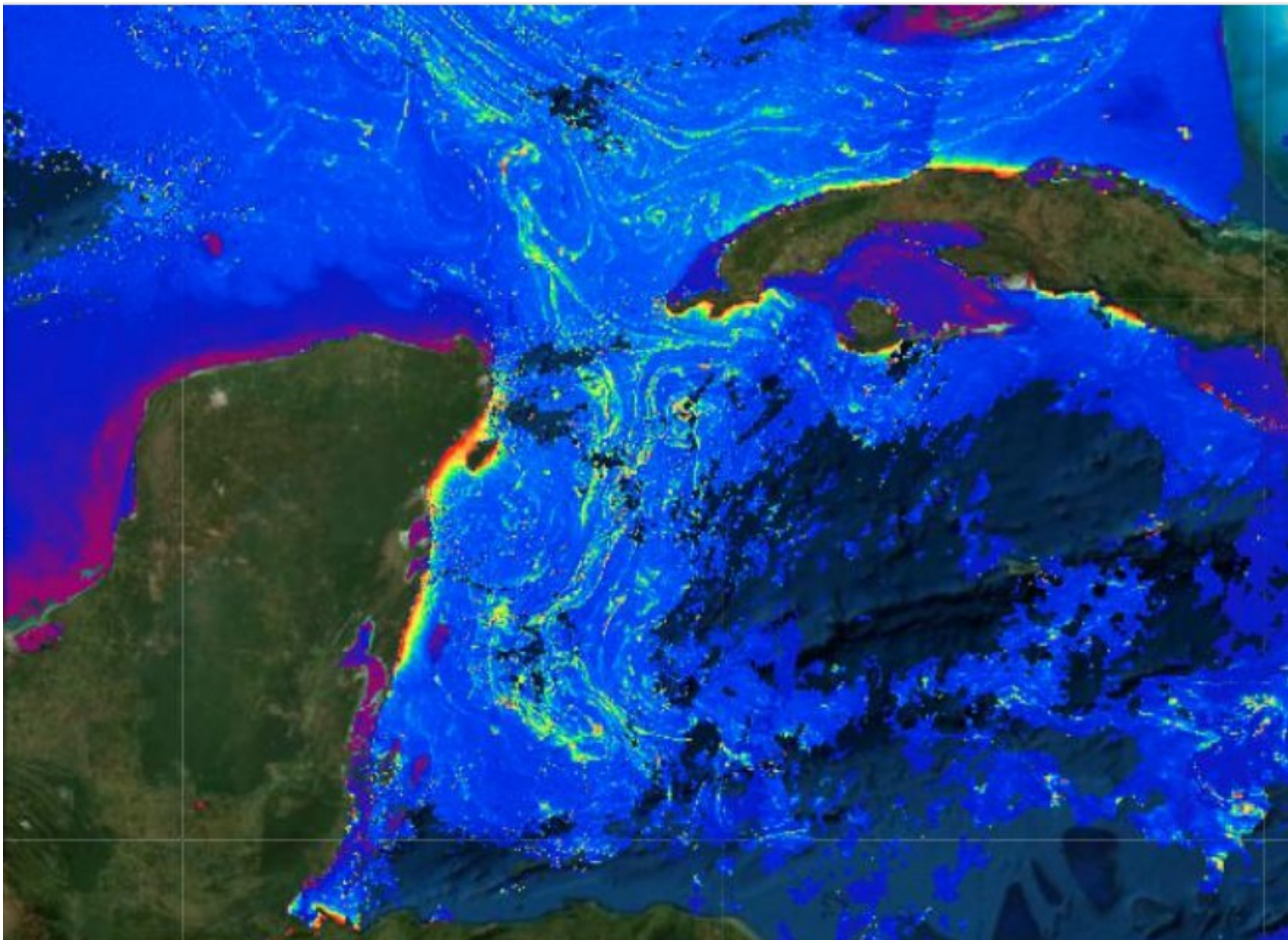
- Can be detected in satellite observations with Hu's FAI & AFAI algorithms



Satellite-based Sargassum Watch System (SaWS)
<https://optics.marine.usf.edu/projects/saws.html>

In **Mexico**: SIMAR ocean monitoring system, CONABIO

- Freely-available U.S. satellite data at 1 km resolution
- Provides early warning of Sargassum arrivals to Mexican Caribbean coast



Ocean Hackaton 2019: French ocean-focused tech competition

- The challenge: improve satellite Sargassum detection



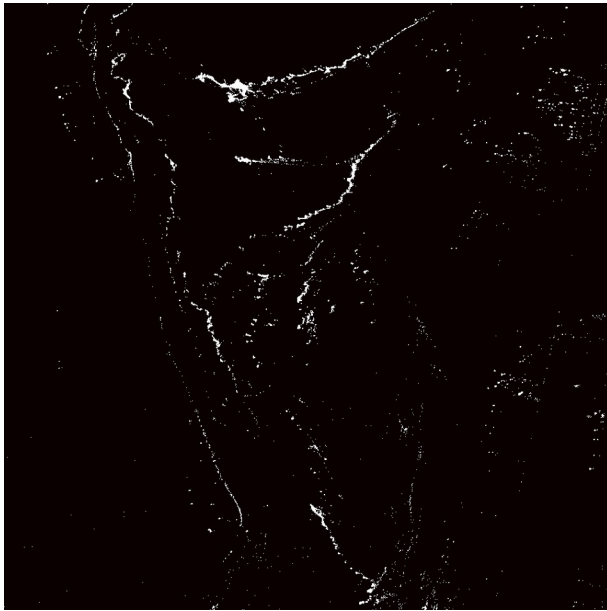
- Multidisciplinary 9-member team: physicists, engineers, programmers
- Students & researchers at Mexican universities
- Our project won first place



Leveraging **Machine Learning** to improve Sargassum detection

- Sentinel-2 (ESA) high-resolution (20 m) satellite imagery
- Once trained, can reproduce existing algorithm's detections >99%

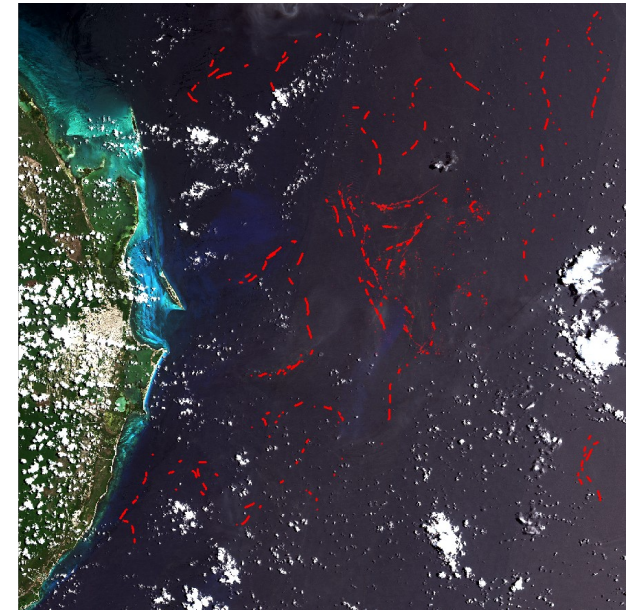
Training



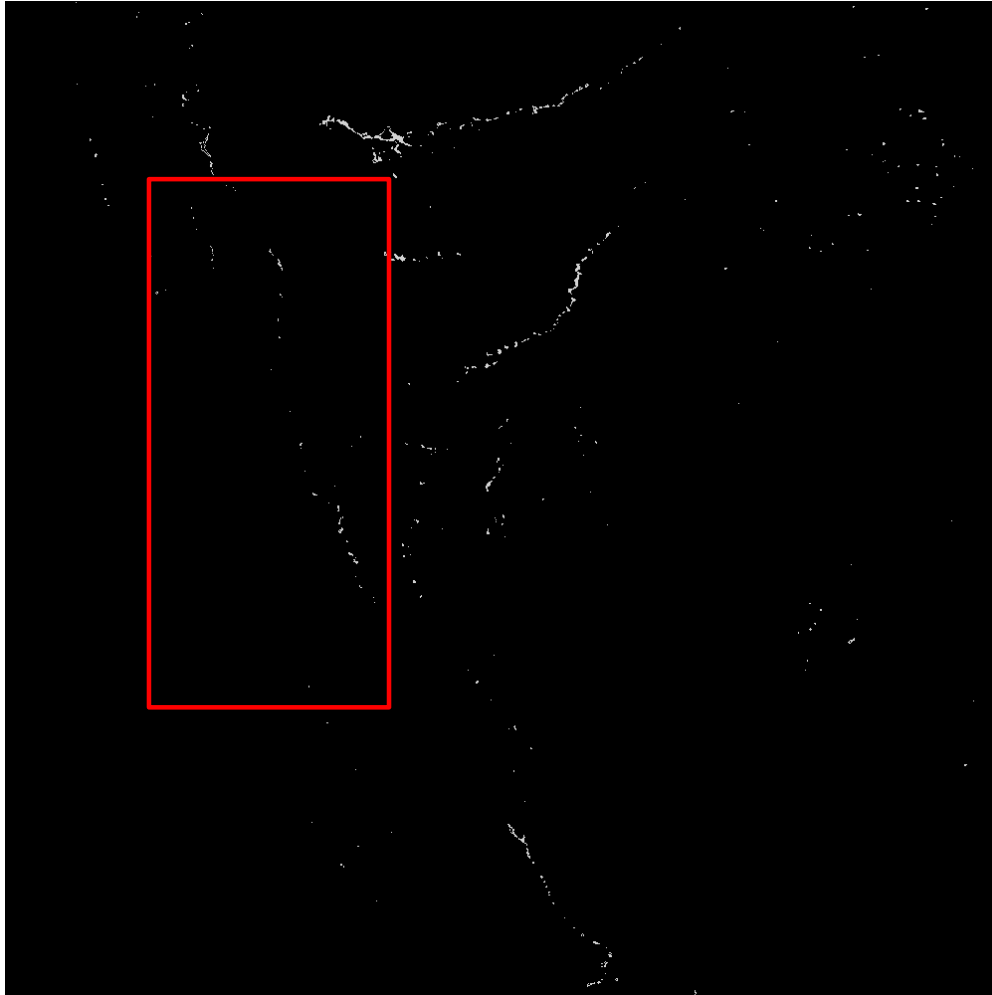
Learning



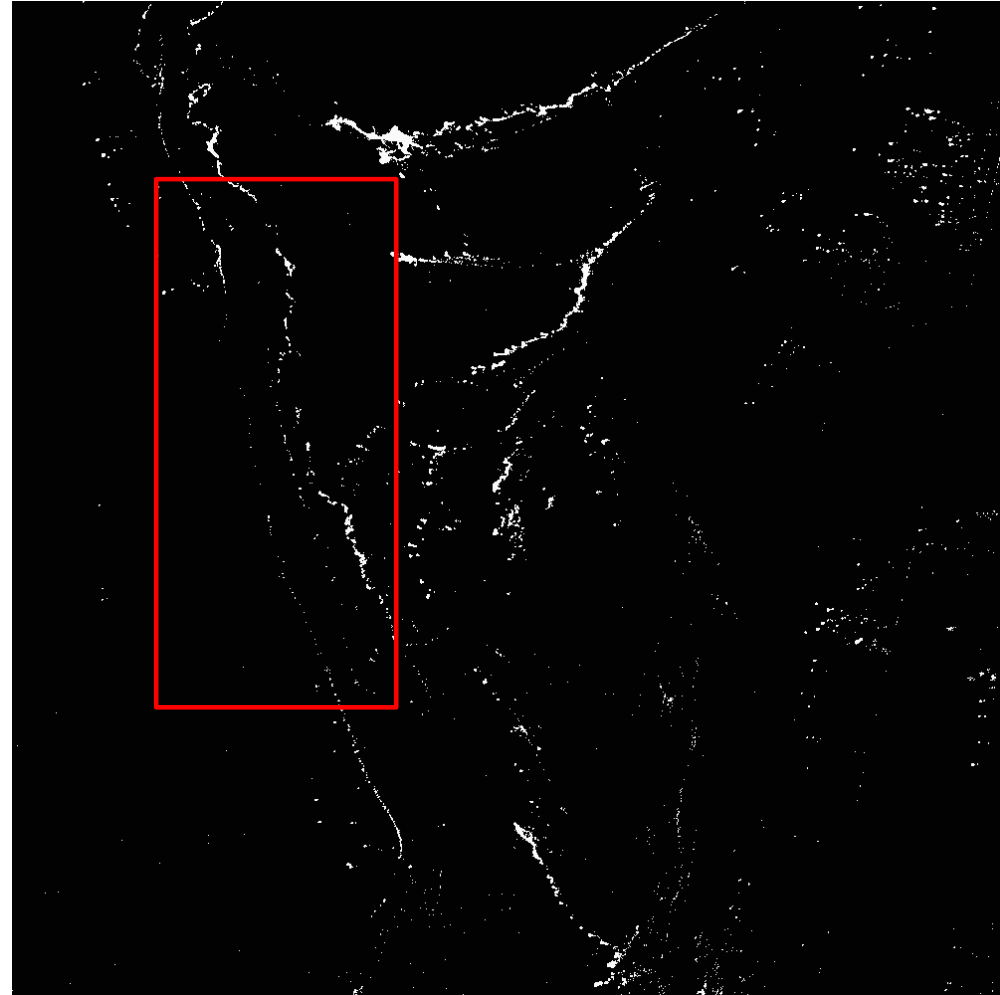
Prediction



New algorithm improves detection compared to AFAI

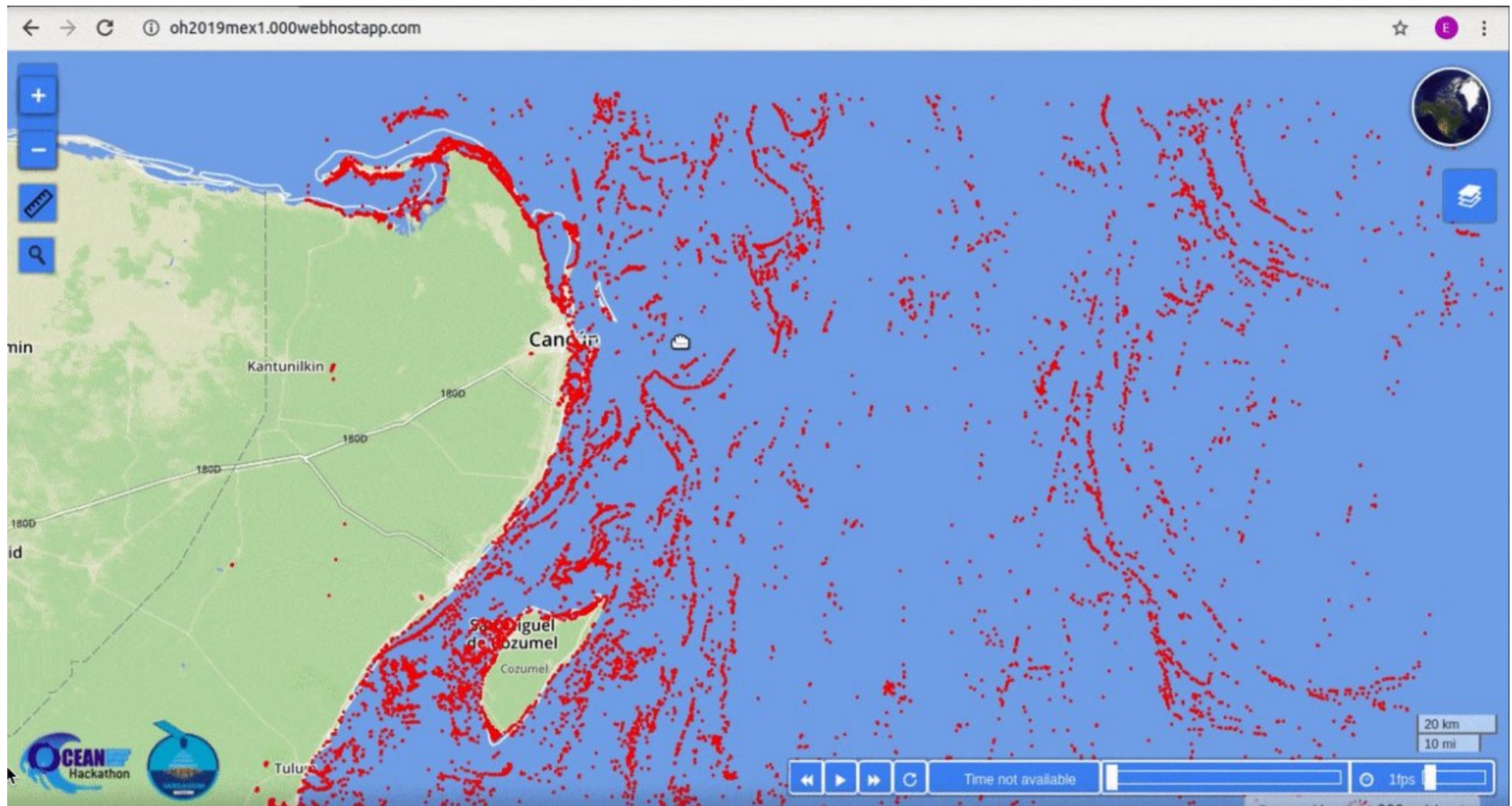


AFAI



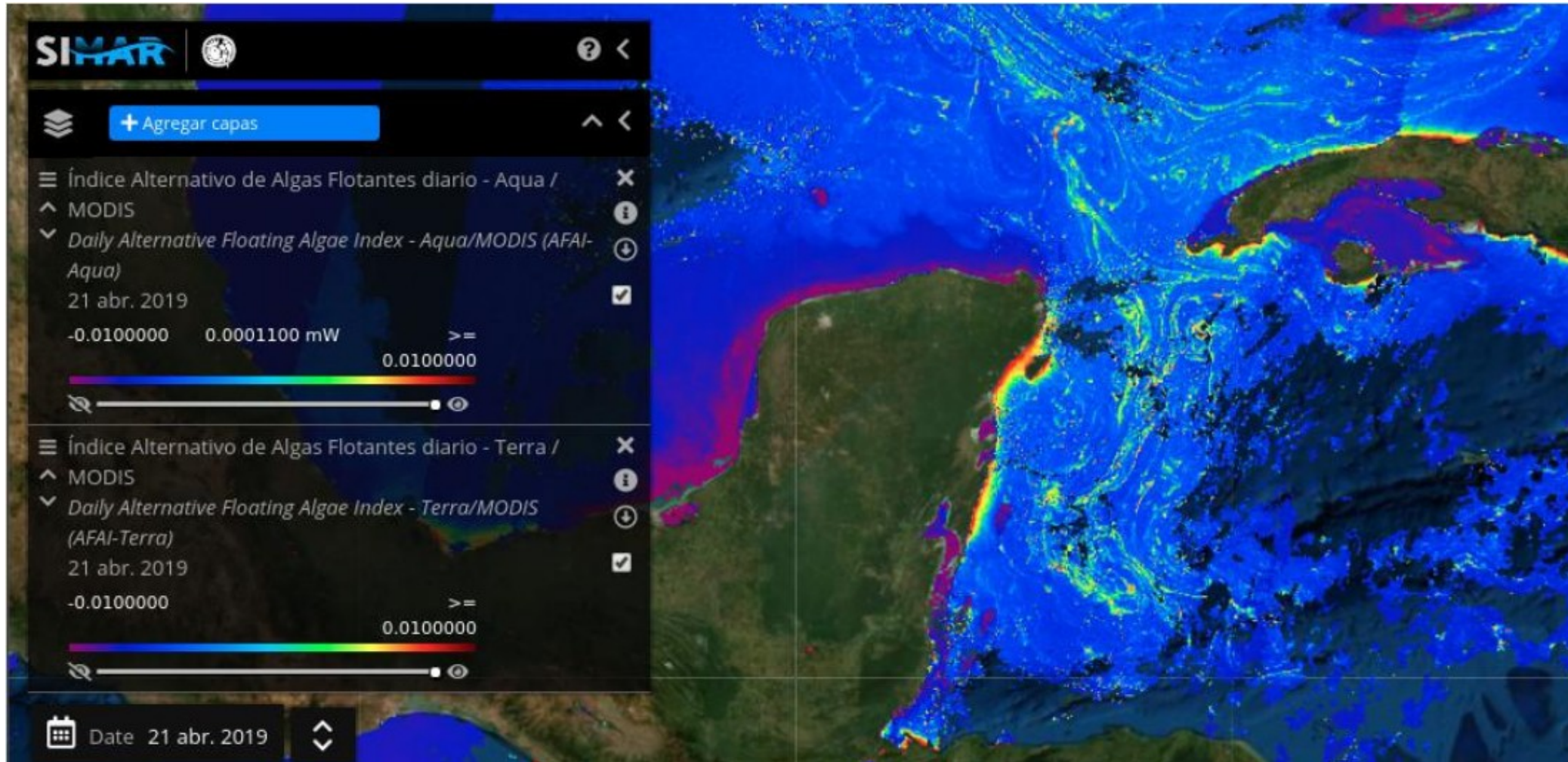
Our algorithm

Interactive webmap application



Live demo: <https://oh2019mex1.000webhostapp.com/>

Soon to be **integrated** into SIMAR ocean monitoring system



<https://simar.conabio.gob.mx>

What's next?

- **Validate** satellite detections using **in-situ** observations (drones, ships)
- **High resolution** data to increase **efficiency** of **collection efforts** in open ocean
- Apply algorithm to **high time-frequency** satellite data (e.g. GOES)
- Create **modern** accessible **tools** (cellphone app?) to better **inform** the **public**

Thank you!

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<https://oceanhackathonmex.wixsite.com/sargassumbusters>

