The Global Seagrass Watch service: Cloud-based Coastal Ecosystem Accounting

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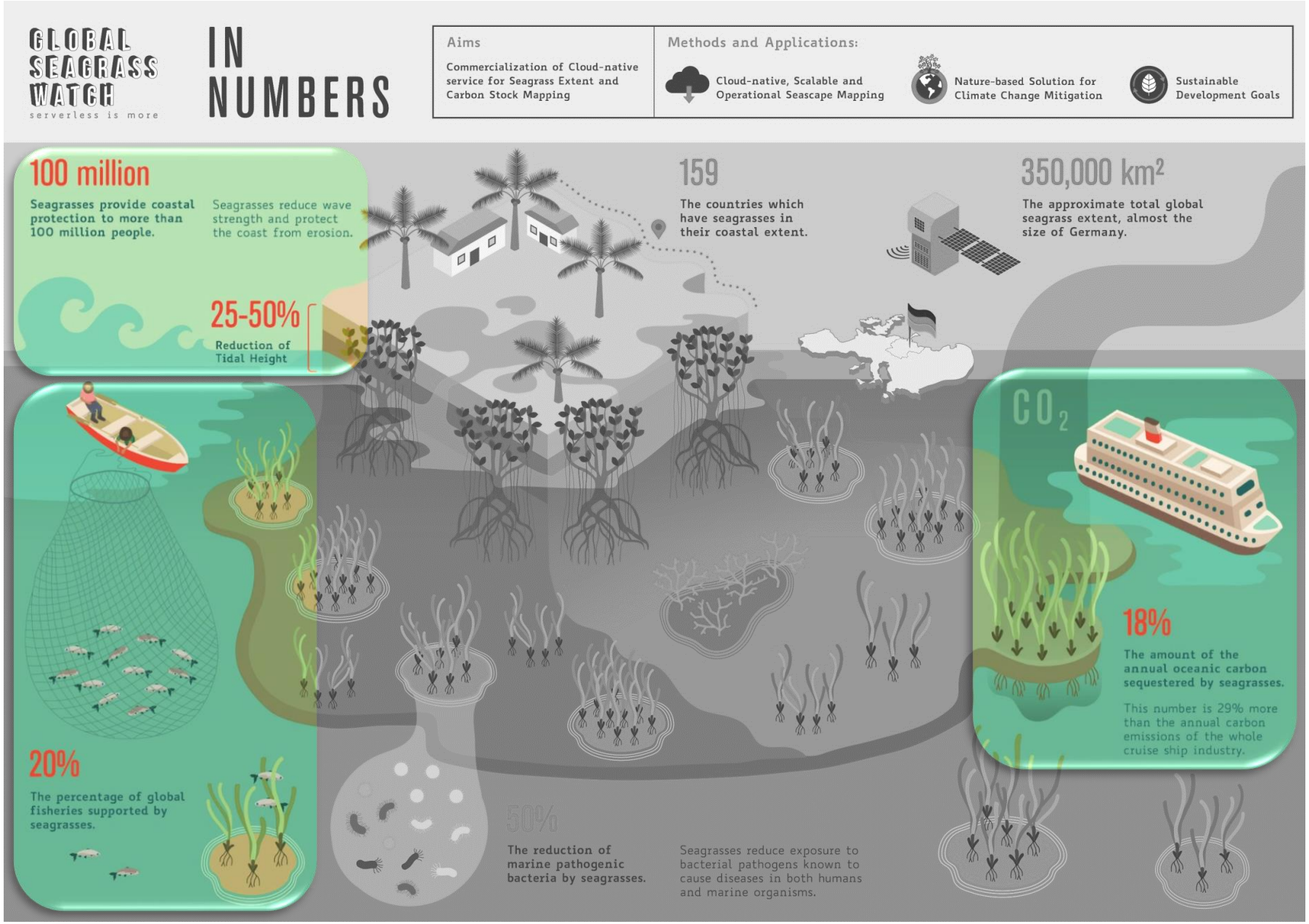
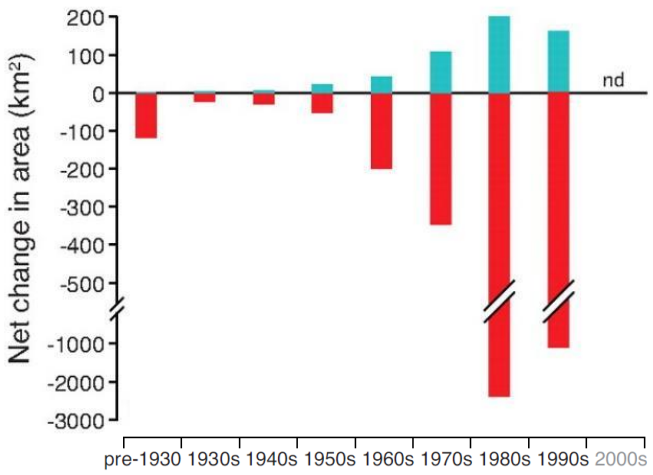
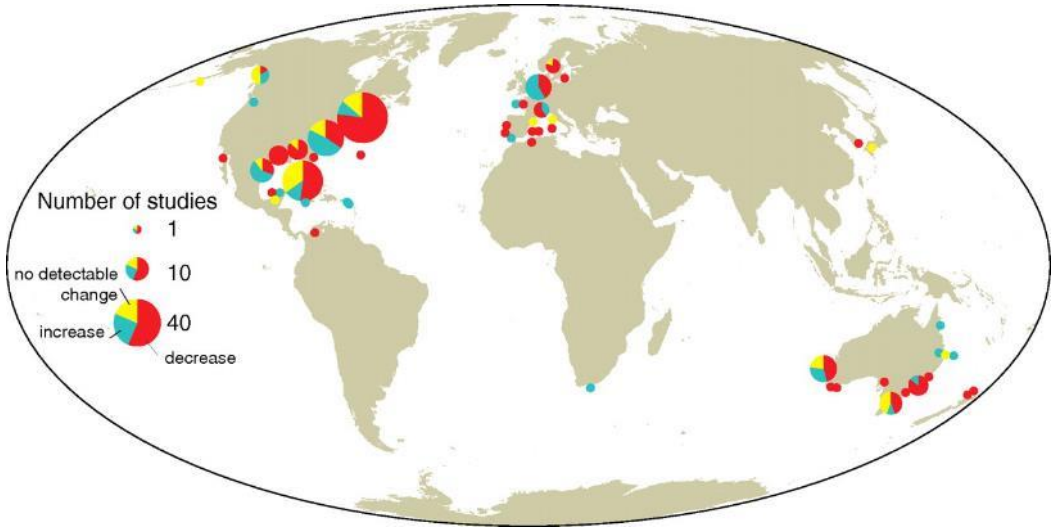
Avi P. Pertiwi
Spyros Christofilakos
Alina Blume

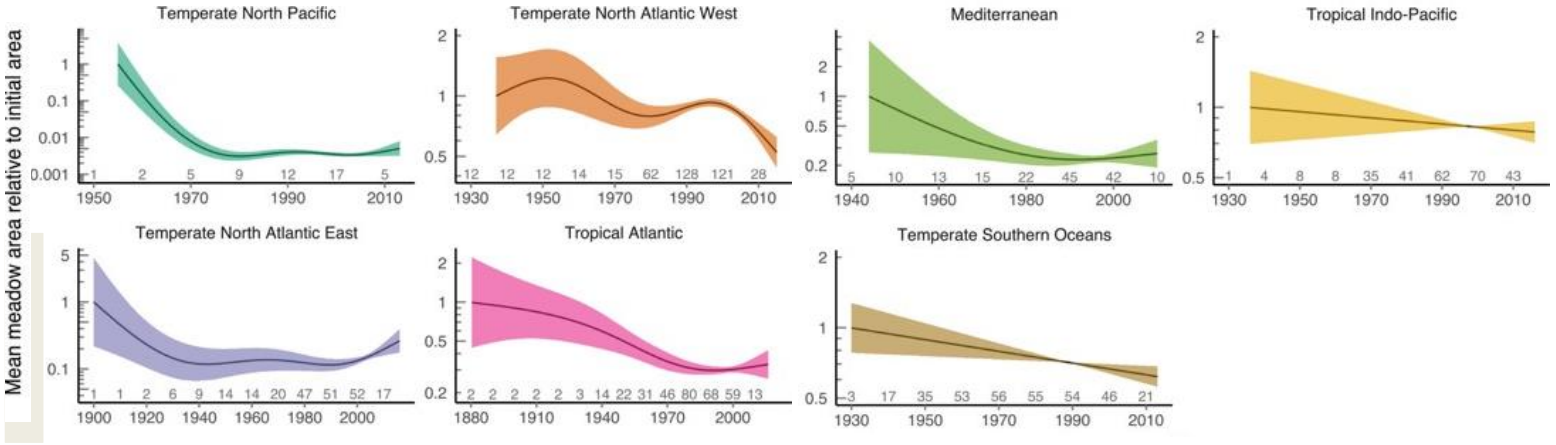
DLR

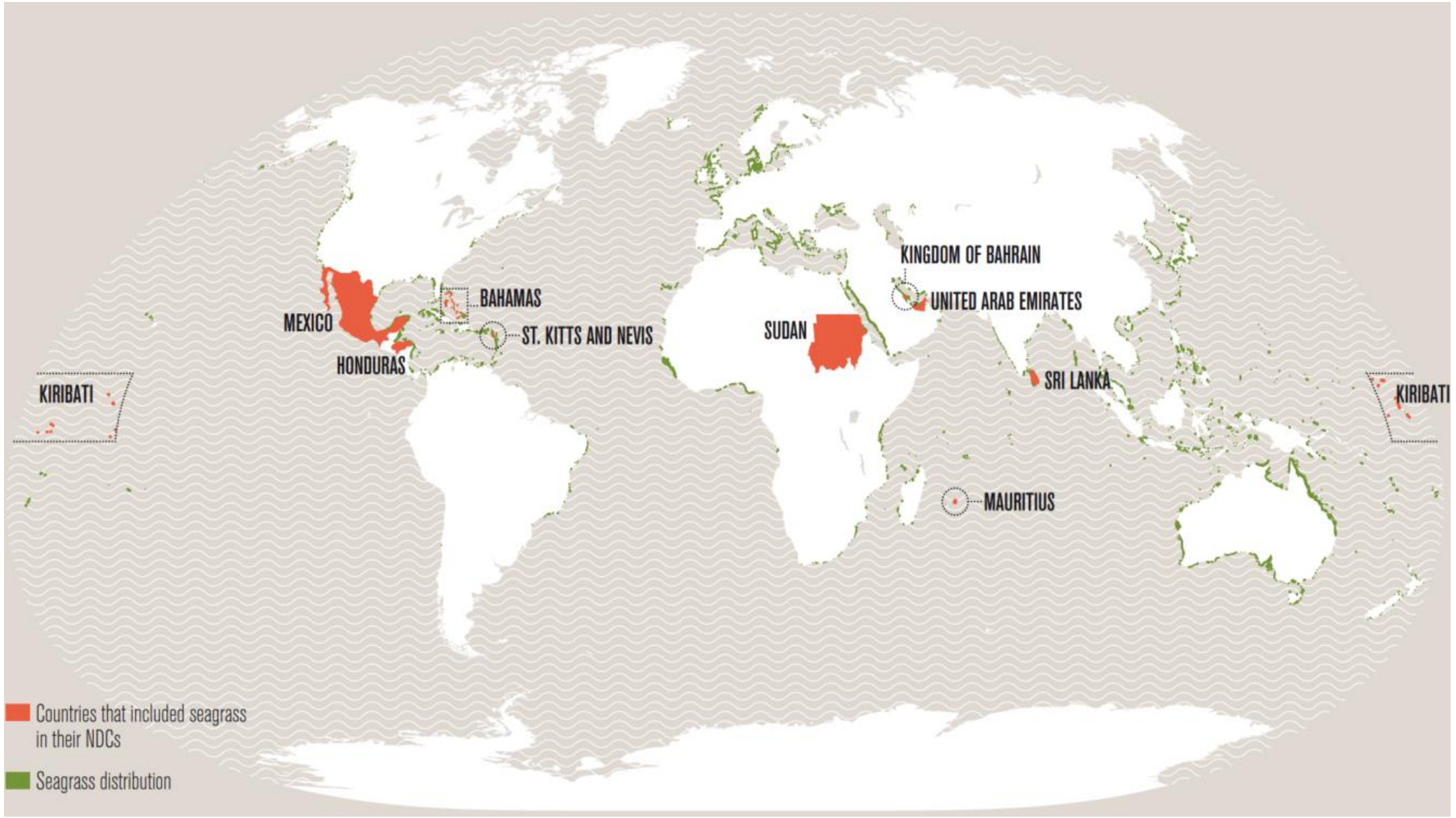

GLOBAL SEAGRASS WATCH
serverless is more
IN NUMBERS
Aims
Commercialization of Cloud-native service for Seagrass Extent and Carbon Stock Mapping
Methods and Applications:
Cloud-native, Scalable and Operational Seascape Mapping
Nature-based Solution for Climate Change Mitigation
Sustainable Development Goals
100 million
Seagrasses provide coastal protection to more than 100 million people.
Seagrasses reduce wave strength and protect the coast from erosion.
25-50%
Reduction of Tidal Height
159
The countries which have seagrasses in their coastal extent.
350,000 km²
The approximate total global seagrass extent, almost the size of Germany.
CO2
18%
The amount of the annual oceanic carbon sequestered by seagrasses.
This number is 29% more than the annual carbon emissions of the whole cruise ship industry.
20%
The percentage of global fisheries supported by seagrasses.
50%
The reduction of marine pathogenic bacteria by seagrasses.
Seagrasses reduce exposure to bacterial pathogens known to cause diseases in both humans and marine organisms.

Global seagrass loss over the past century

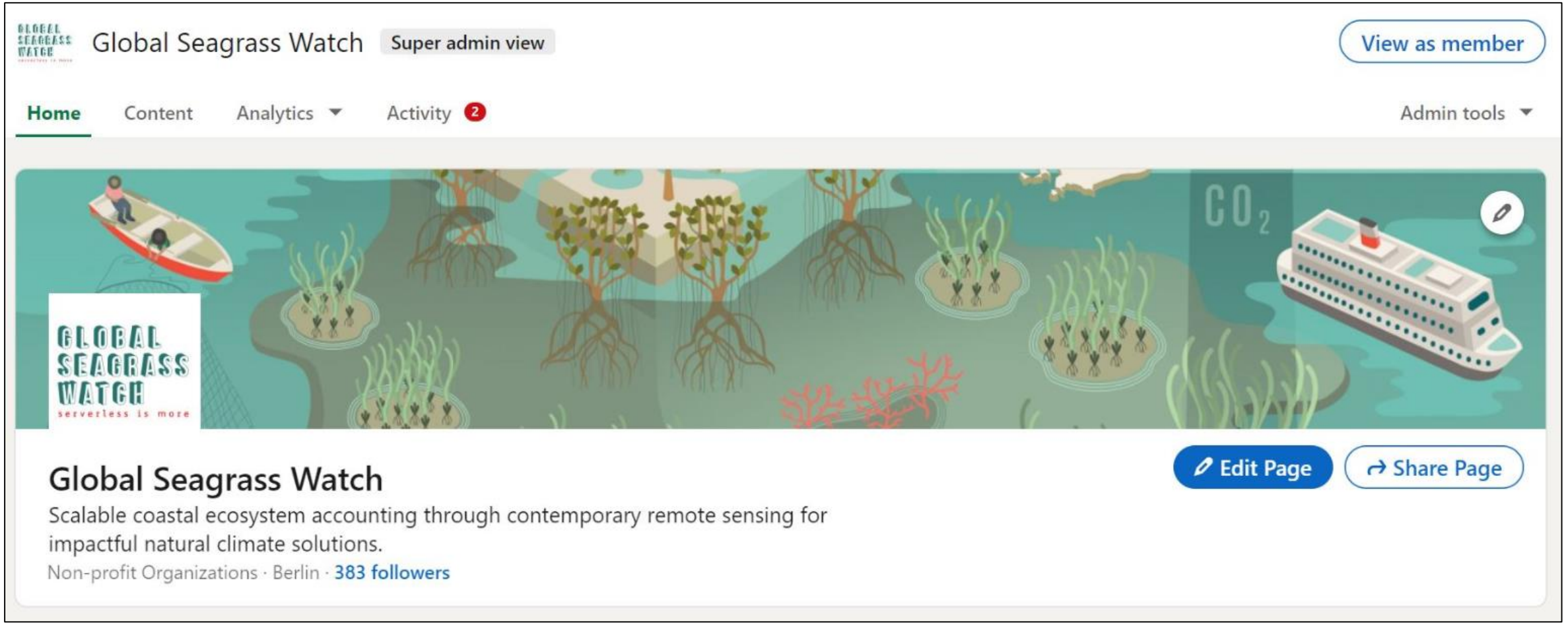







KINGDOM OF BAHRAIN
UNITED ARAB EMIRATES
BAHAMAS
MEXICO
ST. KITTS AND NEVIS
SUDAN
HONDURAS
SRI LANKA
KIRIBATI
KIRIBATI
MAURITIUS
Countries that included seagrass in their NDCs
Seagrass distribution

Earth Observation For Coastal EA:
A Match Made In Heaven For Coastal Ecosystems



https://www.linkedin.com/company/global-seagrass-watch

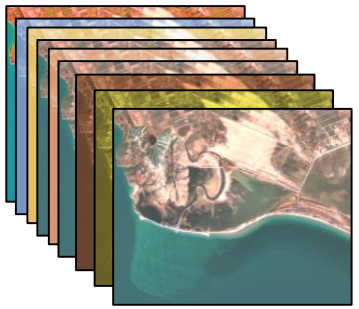
Framework

Powerful Cloud computing

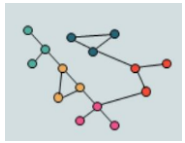
Google Earth Engine

TB-scale satellite data analytics

(Sentinel-2, PlanetScope NICFI)



Machine Learning



Big reference data

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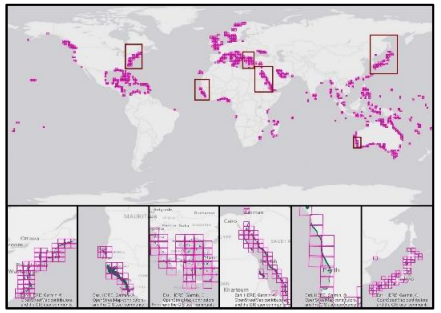
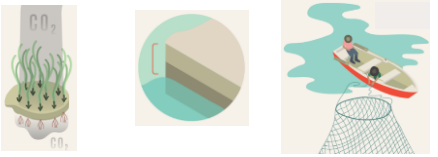
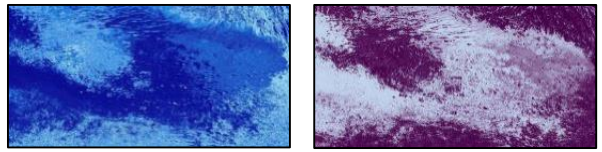
Spatially-explicit seagrass ecosystem extent



Spatially-explicit seagrass ecocystem condition&services



Per-pixel probabilities & uncertainties



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Quantitative EO successes

28 Mapped temperate and tropical countries

306,000 km² Mapped nearshore shallow seabed area at 5/10 m

76,000 km² Mapped spatially-explicit seagrass extent

40% Percent mapped of best-available global extent

Overview of our seagrass mapping work

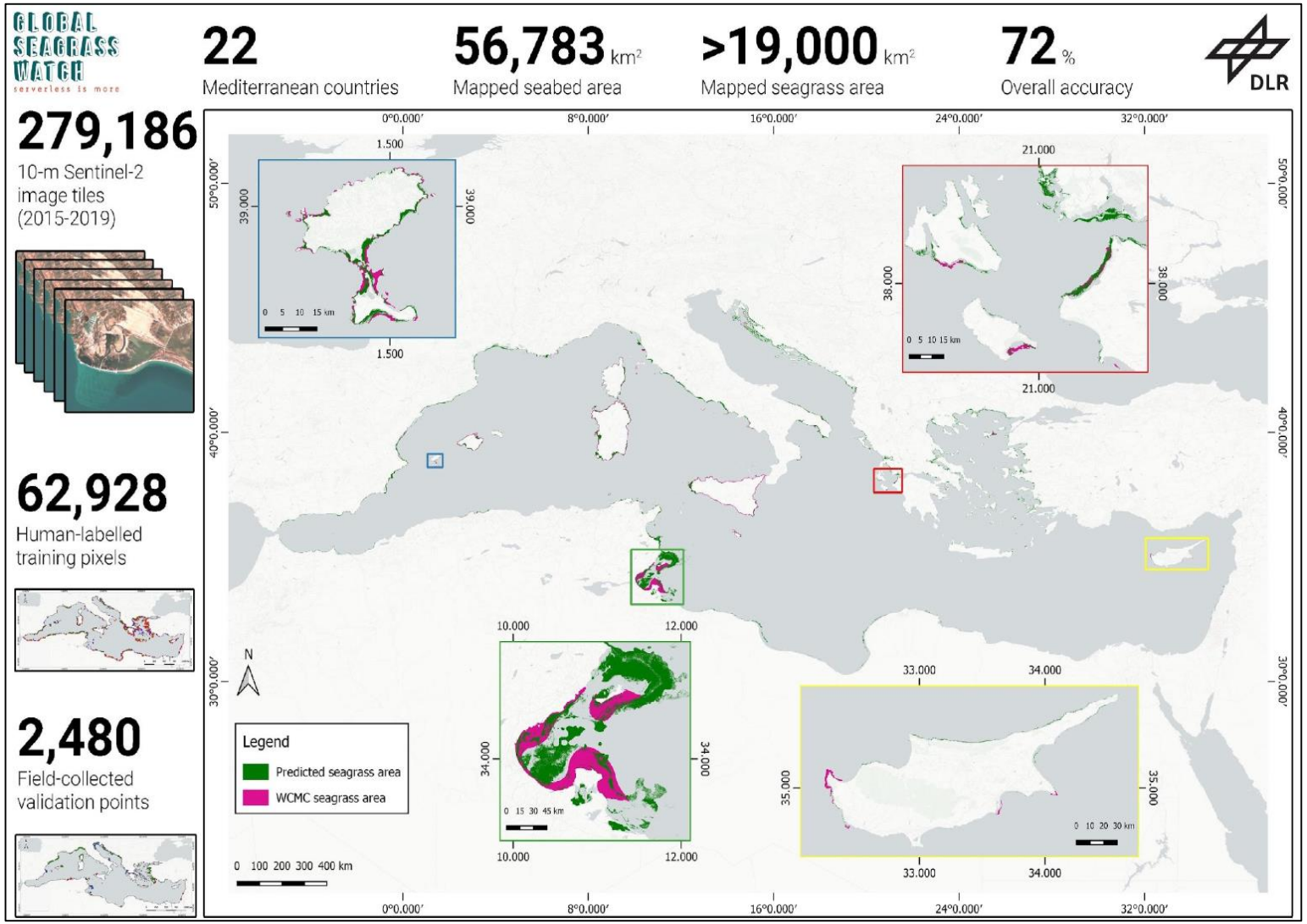
Region	Satellite Imagery	No. of images used	Date Range	Reference Data	Model	Overall accuracy
Mediterranean	Sentinel-2	279,186	Jun 2015 – Dec 2019	Multiclass	Random Forest Soft Probability	72,0%
East Africa		16,453	Dec 2018 – Apr 2020	Binary		84,3%
Bahamas		18,881	Mar 2017 – Mar 2021	Multiclass	Random Forest Soft Probability (Min, Max)	71,0 – 76,5%
Seychelles	Planetscope NICFI	Biannual composites	2015 – 2020	Multiclass	Random Forest (Work in progress)	(Work in progress)
Indonesia		Biannual composites/ Monthly composites	2015 – 2021	Multiclass		(Work in progress)

Pan-Mediterranean Seagrass mapping

Novel

- Expansion from a national scale to a regional scale
- Per-pixel seagrass probability

- Paper: https://www.frontiersin.org/articles/10.3389/fmars.2022.871799/full
- App: https://leechengfa.users.earthengine.app/view/panmediterranean-app

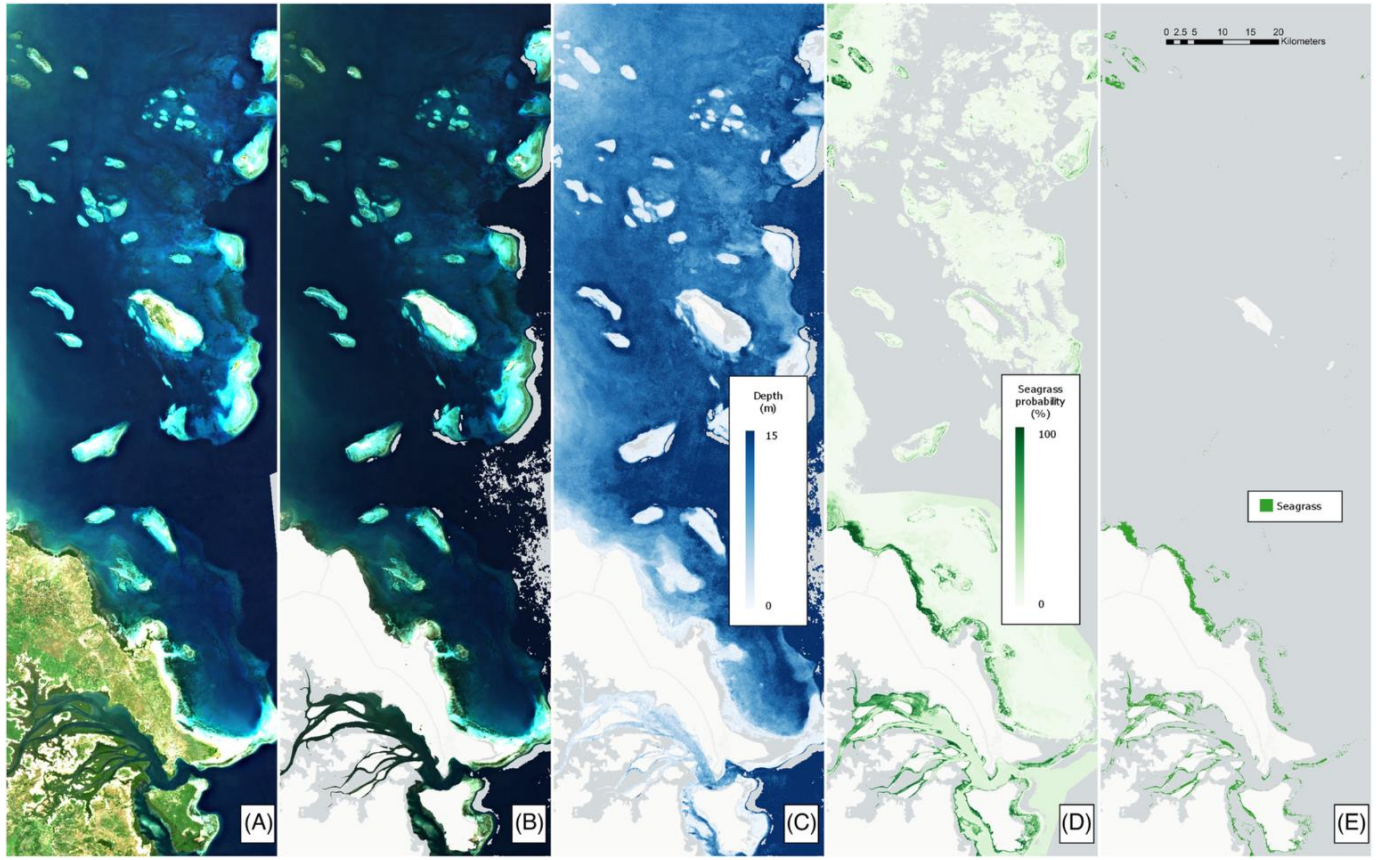


East African Seagrass mapping

Novel

- Turbidity processor
- Two-tiered per-pixel seagrass probability approach

- Paper: https://zslpublications.onlinelibrary.wiley.com/doi/full/10.1002/rse2.287
- App: https://aviputri.users.earthengine.app/view/mappingeastafrica



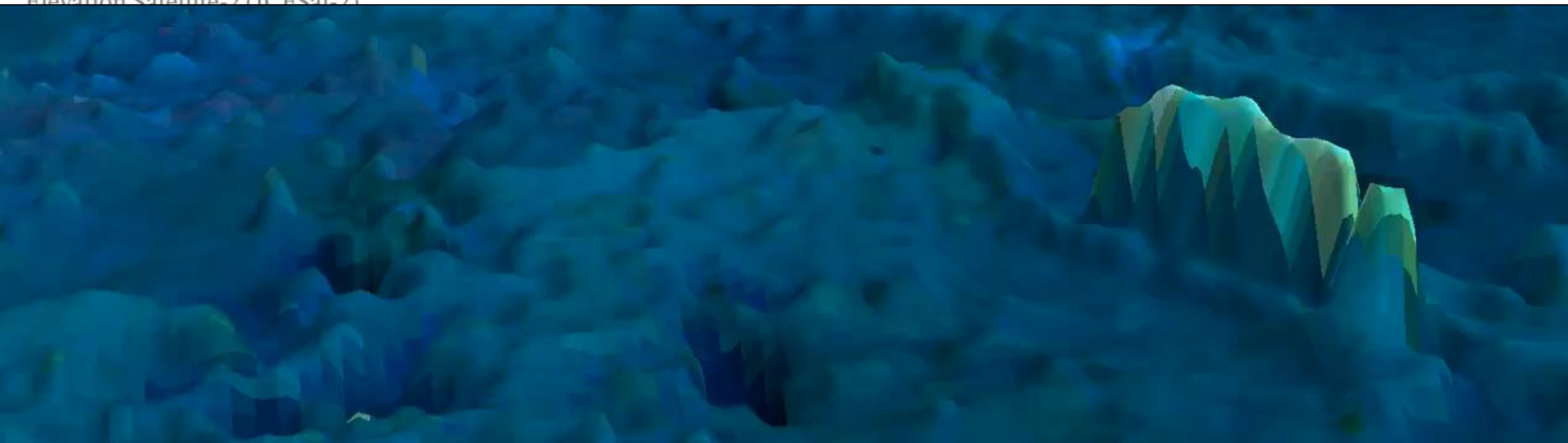
Geophysical Research Letters

RESEARCH LETTER
10.1029/2020GL092170

Special Section:
The Ice, Cloud and land Elevation Satellite-2 (ICESat-2)

Space-Borne Cloud-Native Satellite-Derived Bathymetry (SDB) Models Using ICESat-2 And Sentinel-2

N. Thomas[1,2], A. P. Pertiwi[3], D. Traganos[3], D. Lagomasino[4], D. Poursanidis[5], S. Moreno[4], and L. Fatoyinbo[2]

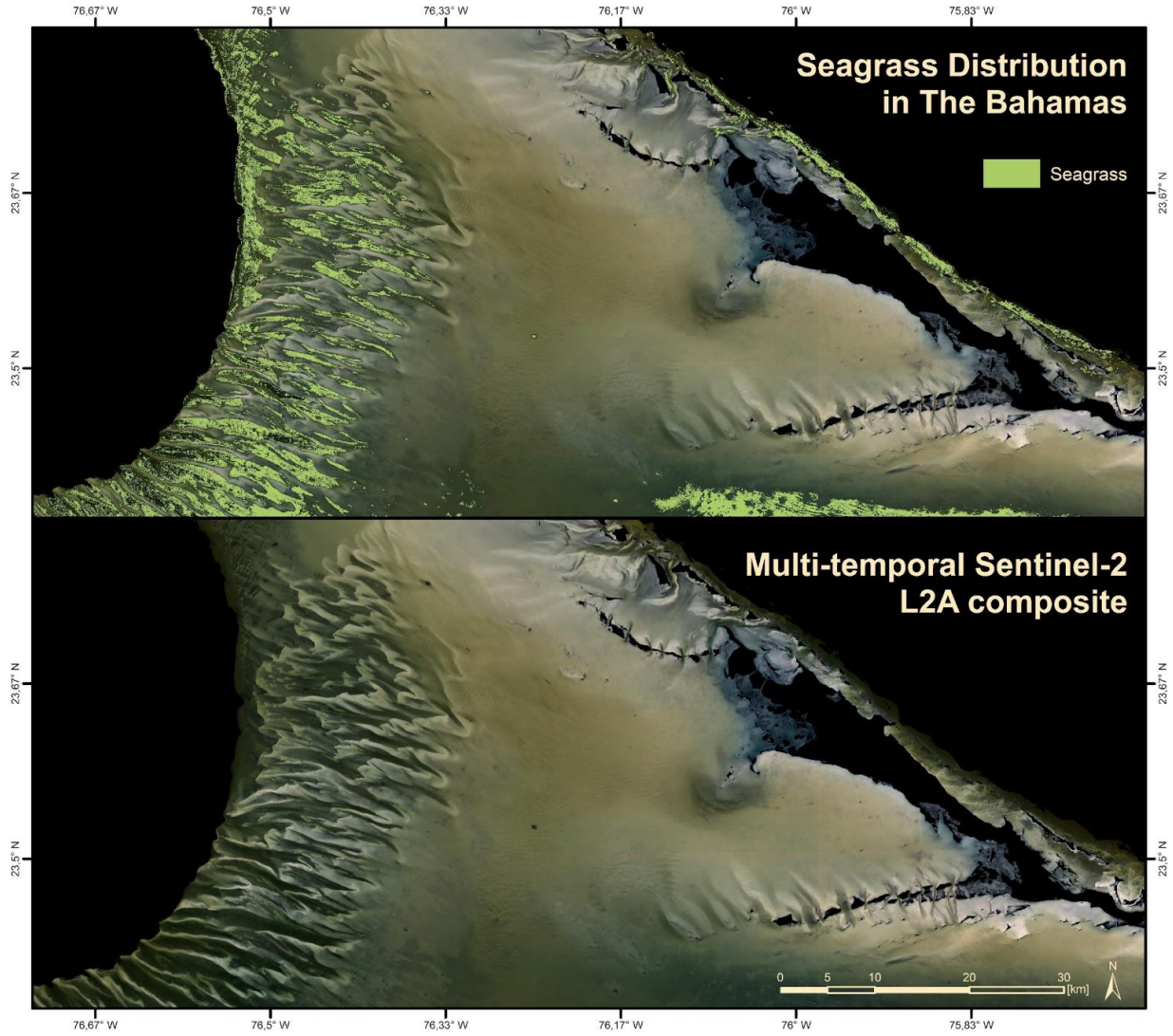


Bahamian Seagrass mapping

Novel

- Normalisation of training and validation data
- Minimum and Maximum extent of seagrass

- Paper: Accepted, in press
- App: https://ablume.users.earthengine.app/view/bahamian-seagrass-extent



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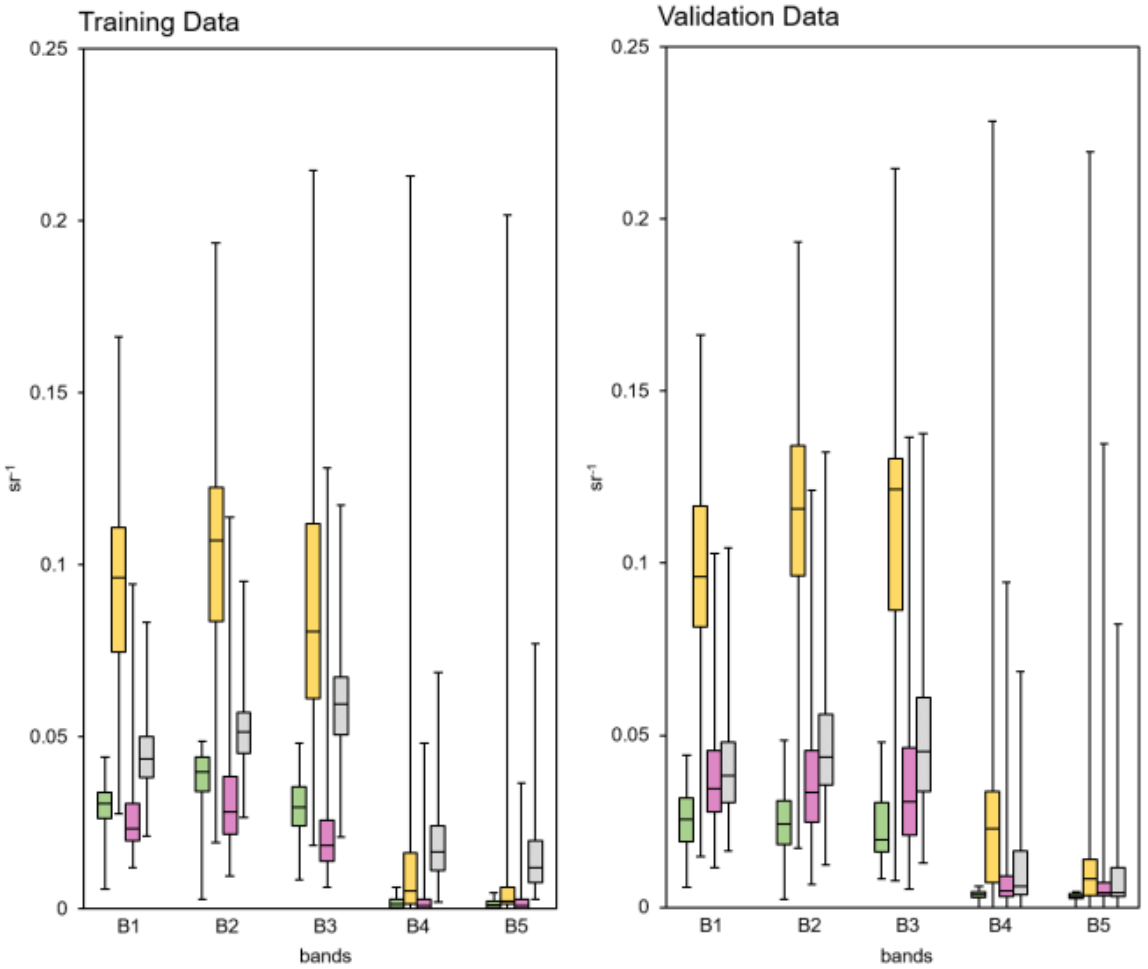

Seychelles Seagrass mapping

- First ever actionable nationwide seagrass mapping globally
- Uptake in national climate and MPA agenda, and blue carbon crediting mechanisms by 2025
- Poster session: Thursday (AM)

NATIONAL NEWS

NATION

Seychelles fulfills first climate commitment

YOUR HOROSCOPE

Active Covid-19 cases down from 177 cases last week to 168

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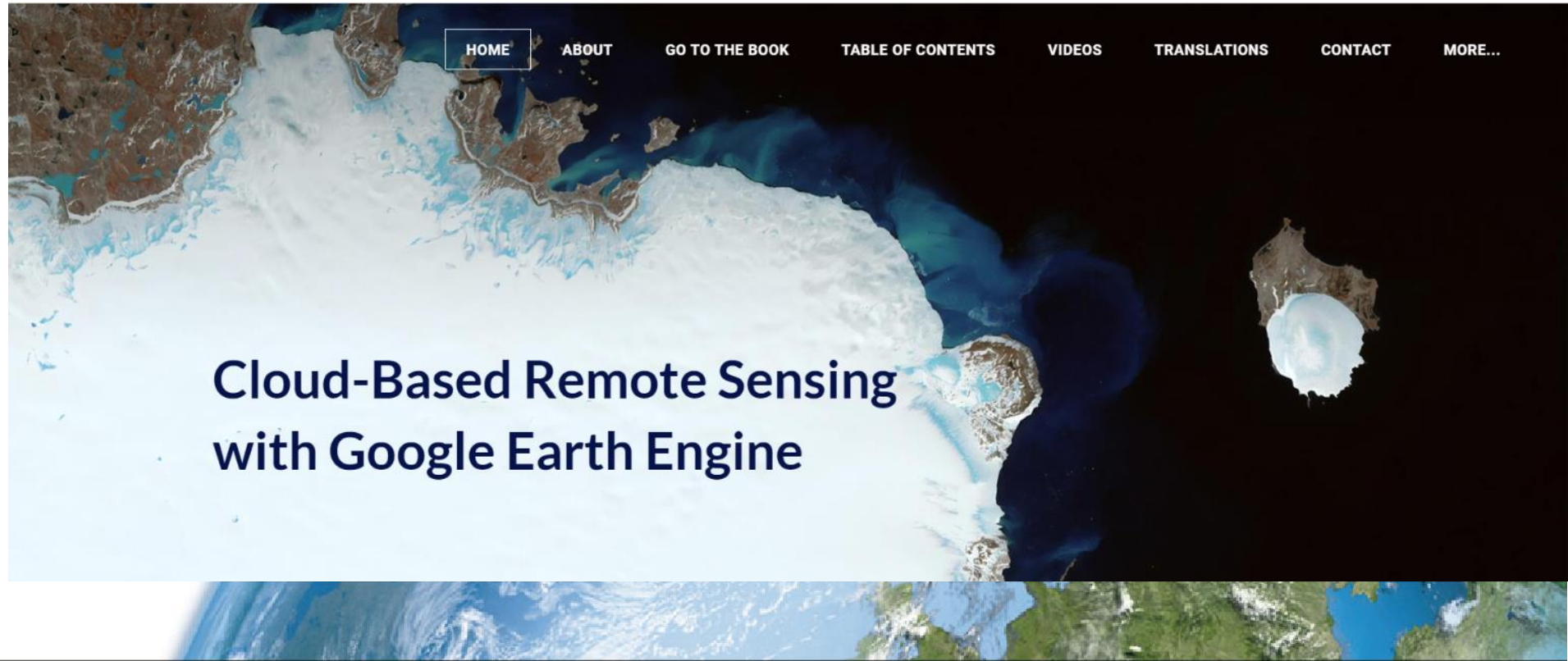
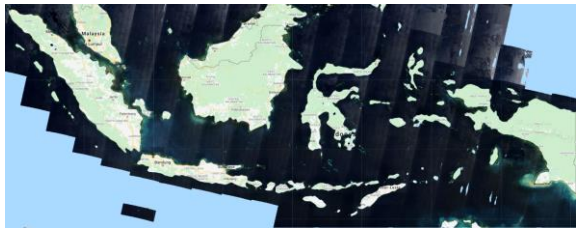
Coding Framework

- Earth Engine Fundamentals and Application
  - Chapter A2.2: Benthic Habitats
    - https://www.eefabook.org/
    - Includes contributions by Spyros Christofilakos, a member of the Global Seagrass Watch team



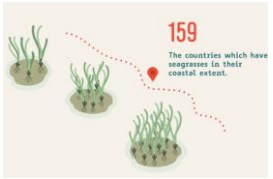
Present Challenges to be surmounted

Accurate deep seagrass ecosystem extent

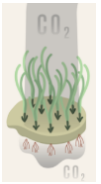


Remaining challenges in scalable multi-temporal analytics

Problematic tracking of progress of relevant Multilateral Environmental Agreements (NDCs, SDGs, MPAs, CBD)



Lack of big satellite data fusion and fit-for-purpose reference seagrass extent data



Lack of nation/region-specific in-situ physical and thematic accounts

Into the Future

- Holistic **systems-level approach** by fusing Earth Observation, Ecosystem Accounting and biophysical models
- Collaboration with scientists for **integration** of new big **field** reference **data**
- Collaboration with policy makers to streamline **spatially explicit and uncertainty** aware coastal conservation and restoration
- Collaboration with governments, industry and NGOs to improve funding for long-term, **holistic ecosystem service accounting**, reliant on ecology and translated into economic units and measurable targets

Thank you for your attention

Any questions? Contact me at chengfa.lee@dlr.de!

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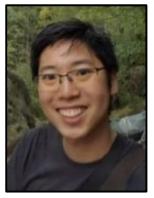
https://www.linkedin.com/company/global-seagrass-watch/

Spatially-explicit Uncertainty of Remote Sensing Coastal Biodiversity Products

Seychelles seagrass mapping

Dimos Traganos
Project Manager

Avi Putri Pertiwi
Research Scientist



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