EARTH OBSERVATION FOR COASTAL ECOSYSTEM ACCOUNTING: A MATCH MADE IN HEAVEN FOR NATURAL CLIMATE SOLUTIONS

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Magadascar, Multi-annual Sentinel-2 mosaic

GLOBAL SEAGRASS WATCH

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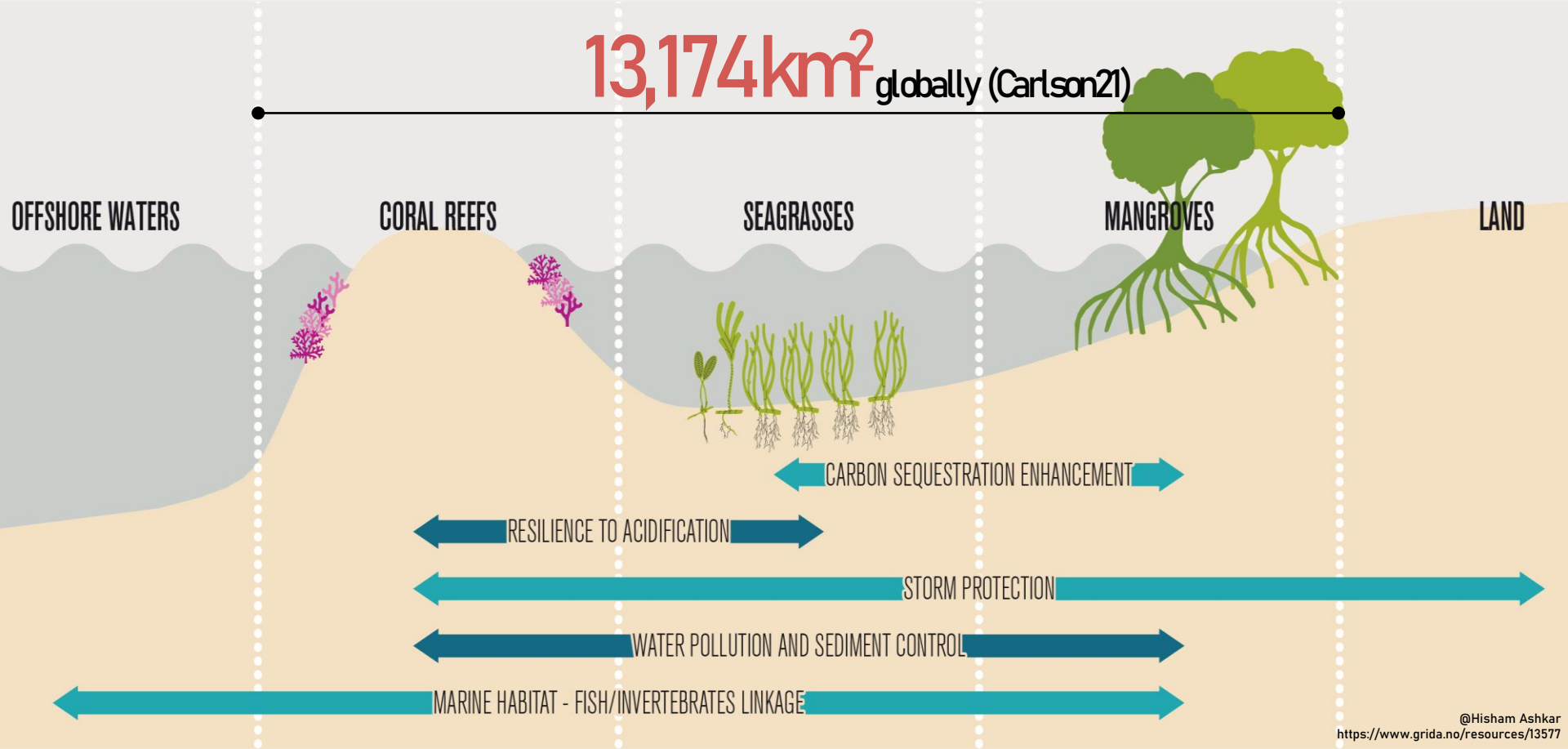
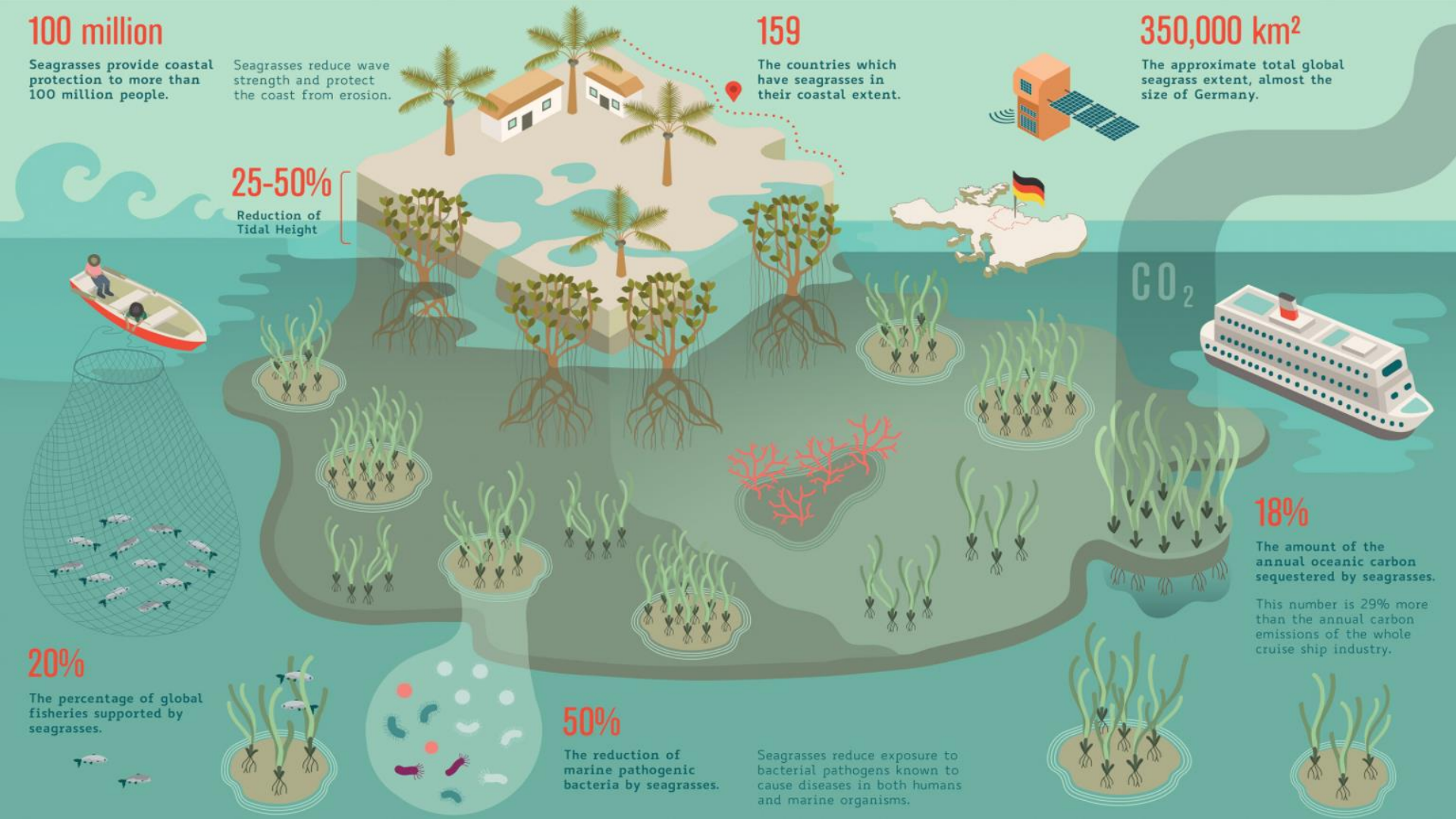
LPS22, A2.02 Ecosystem Accounting – 24.05.2022

INTERCONNECTED COASTAL NATURAL CLIMATE SOLUTIONS

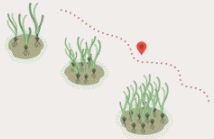


@Hisham Ashkar
https://www.grida.no/resources/13577


100 million
Seagrasses provide coastal protection to more than 100 million people.
Seagrasses reduce wave strength and protect the coast from erosion.
159
The countries which have seagrasses in their coastal extent.
350,000 km²
The approximate total global seagrass extent, almost the size of Germany.
25-50%
Reduction of Tidal Height
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.

KNOWLEDGE GAPS AND UNCERTAINTIES

- Uncertainty in global seagrass extent: 160,387–4,320,000 km^2 (Fourqurean12; Jayathilake18; McKenzie20; UNEP18)

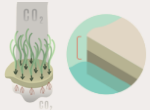


- Sparsity in scalable, standardized and spatially explicit monitoring frameworks

- Uncertainties in global seagrass ecosystem condition and services:

  Global carbon stock: 4.2–19.9 PgC (Fourqurean12)

  Global carbon sequestration rate: 4.8–87.3 $TgC\ yr^{-1}$ (McLeod11)



- Only 17% within MPAs vs 40% of corals & 43% of mangroves (UNEP20)

- Lack of relevant seagrass indicators & tracking of progress of pertinent Multilateral Environmental Agreements (CBD, IPBES, NDCs, SDGs, MPAs)

THE GLOBAL SEAGRASS WATCH PROJECT

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2019–2022

529,000 EUR

technology transfer fund

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

2020–2022

125,000 EUR

technical support

Google Earth Engine

GEO

THE SCALABLE ECOSYSTEM ACCOUNTING PROTOTYPE

Powerful Cloud computing

Google Earth Engine

TB-scale satellite data analytics
(Sentinel-2, PlanetScope NICFI)

Machine Learning

Big reference data

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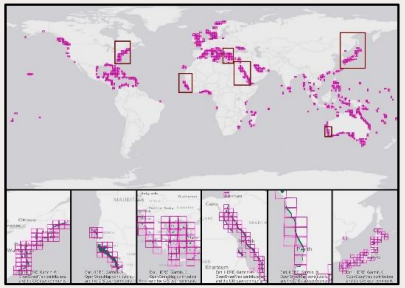
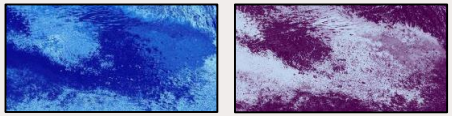
Spatially-explicit
Seagrass ecosystem extent

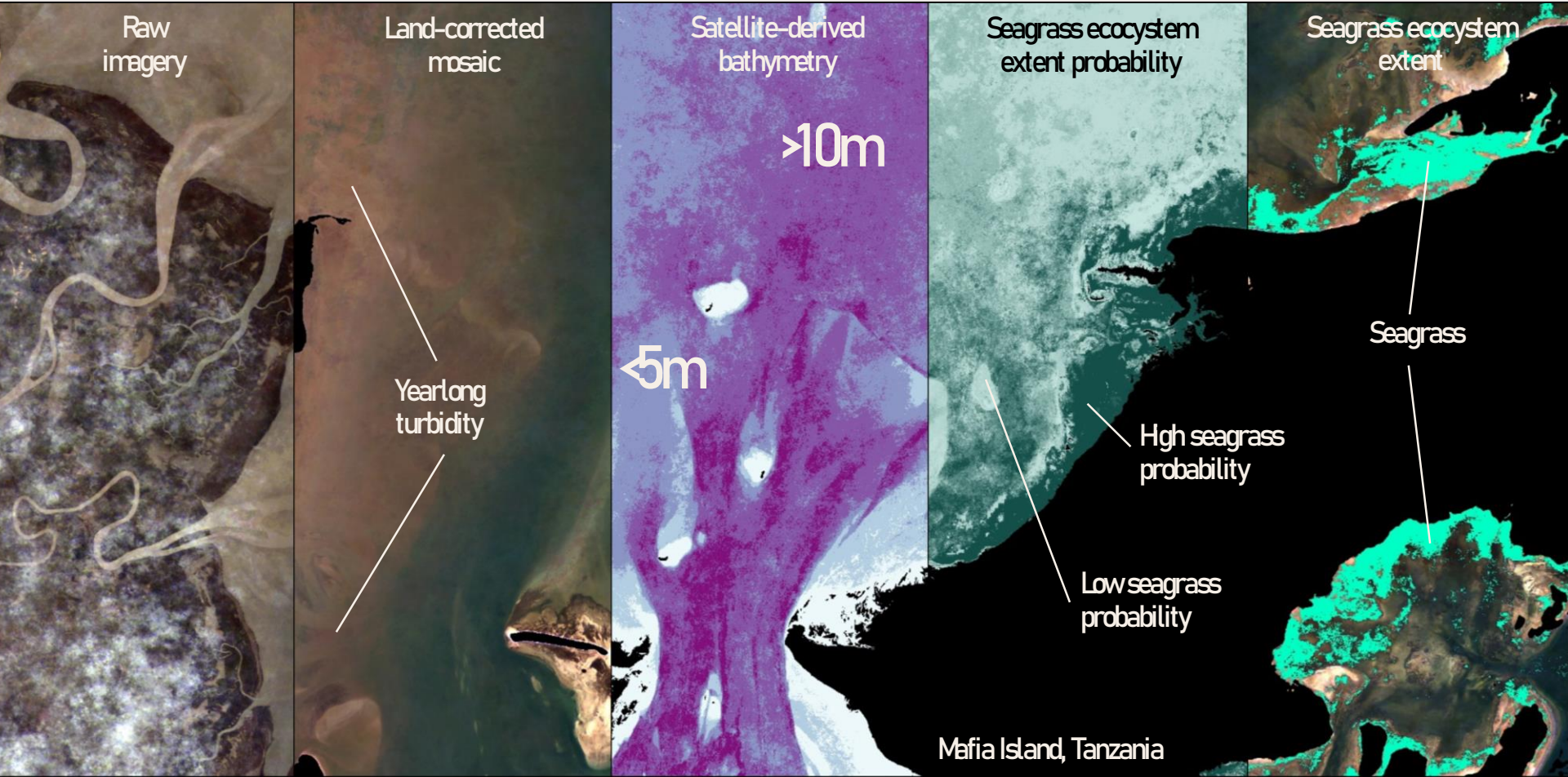


Spatially-explicit
seagrass ecocystem condition&services

Per-pixel
probabilities and uncertainties



SPATIALLY-EXPLICIT SEAGRASS ECOSYSTEM ACCOUNTS



MULTI-NATIONAL TEMPERATE SEAGRASS ECOSYSTEM ACCOUNTING (19-20)

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22
Mediterranean countries

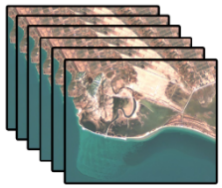
56,783 km²
Mapped seabed area

>19,000 km²
Mapped seagrass area

72 %
Overall accuracy

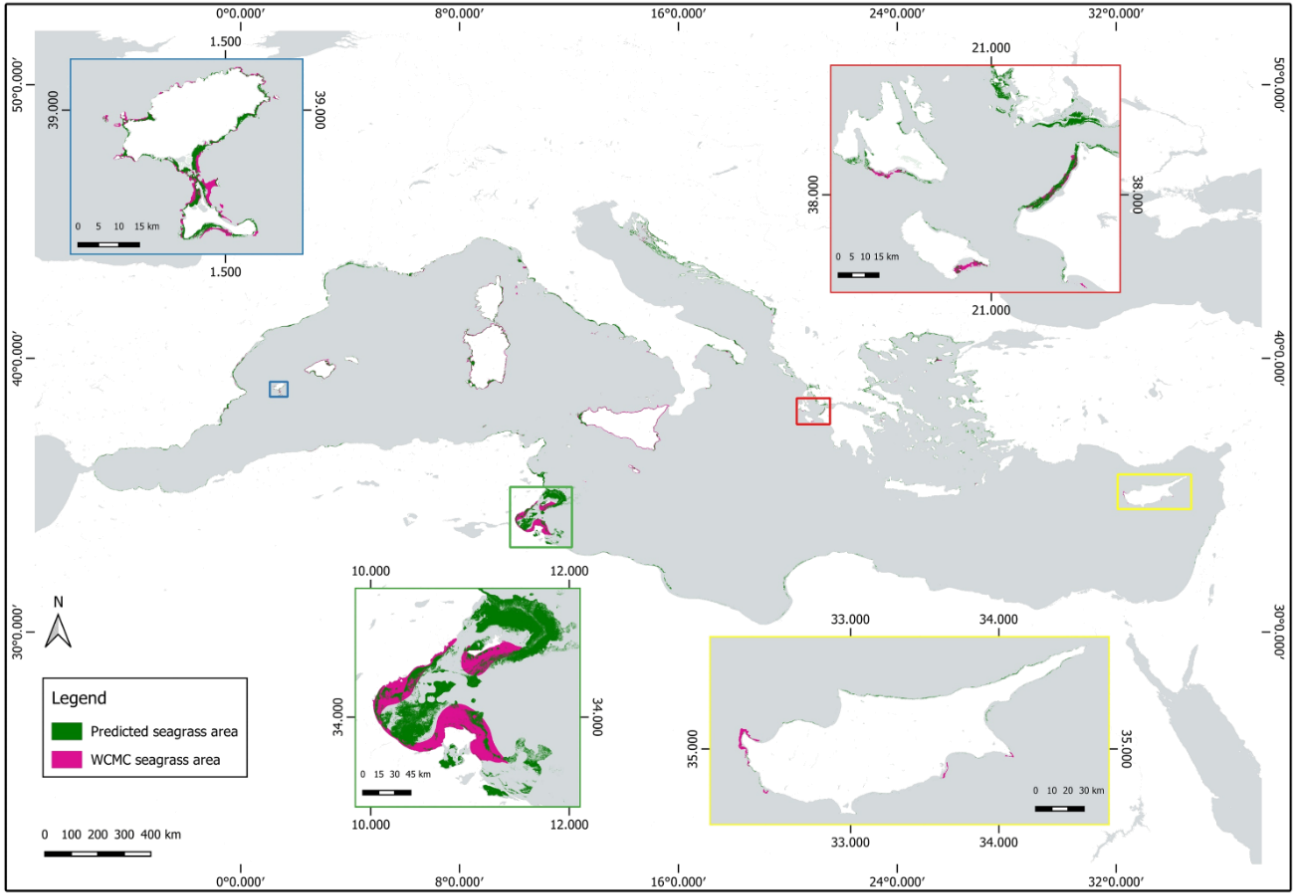
DLR

279,186
10-m Sentinel-2 image tiles (2015-2019)



62,928
Human-labelled training pixels

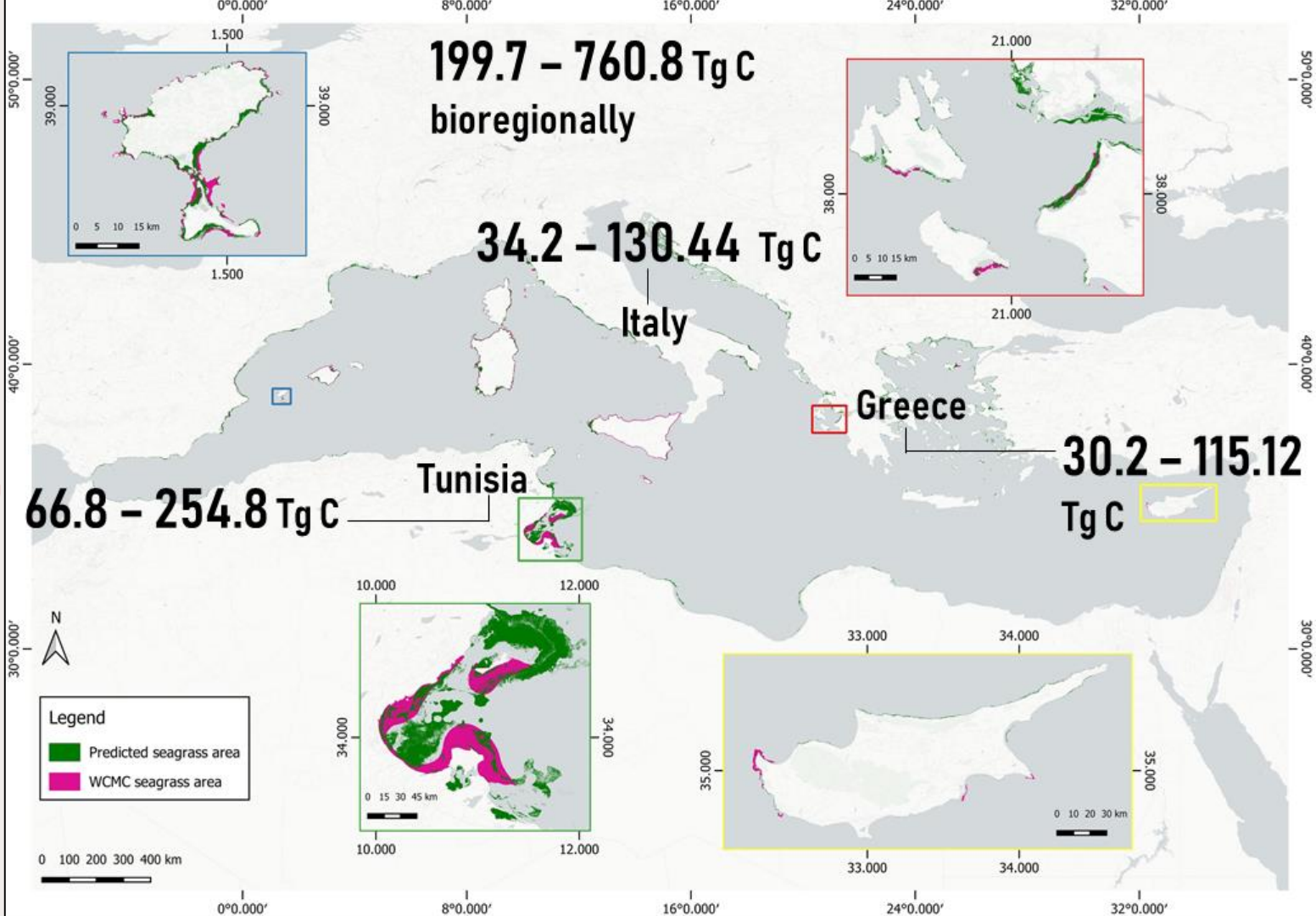
2,480
Field-collected validation points



Traganos et al. (2020). *Cloud-native advances in Earth Observation reveal the pan-Mediterranean extent of the Posidonia oceanica seagrass ecosystem.* Manuscript submitted for publication.

MULTI-NATIONAL TEMPERATE SEAGRASS ECOSYSTEM ACCOUNTING

Tier 1 assessment (IPCC, 2013)



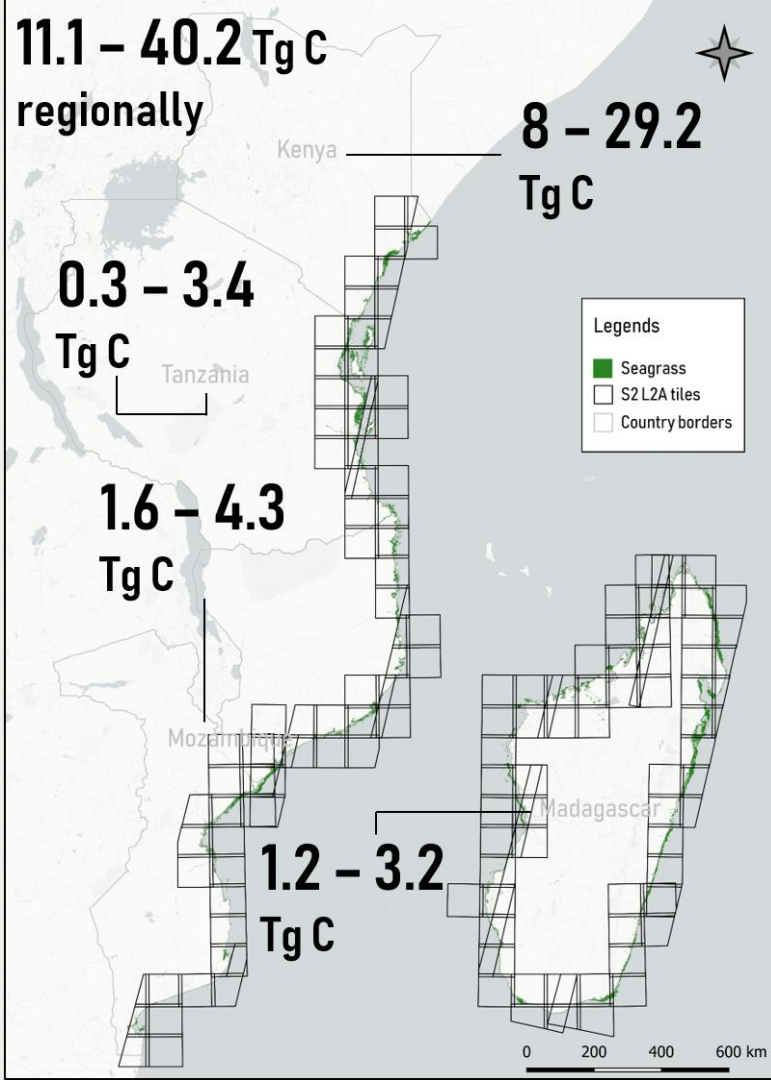
EAST AFRICAN TROPICAL SEAGRASS ECOSYSTEM ACCOUNTING (20-21)

4,316 km² of seagrass ecosystem extent

Up to **40.2 TgC** of total seagrass carbon stocks

Tier 2 assessment (IPCC, 2013)

Publicly-available field-collected seagrass carbon stocks



WWF

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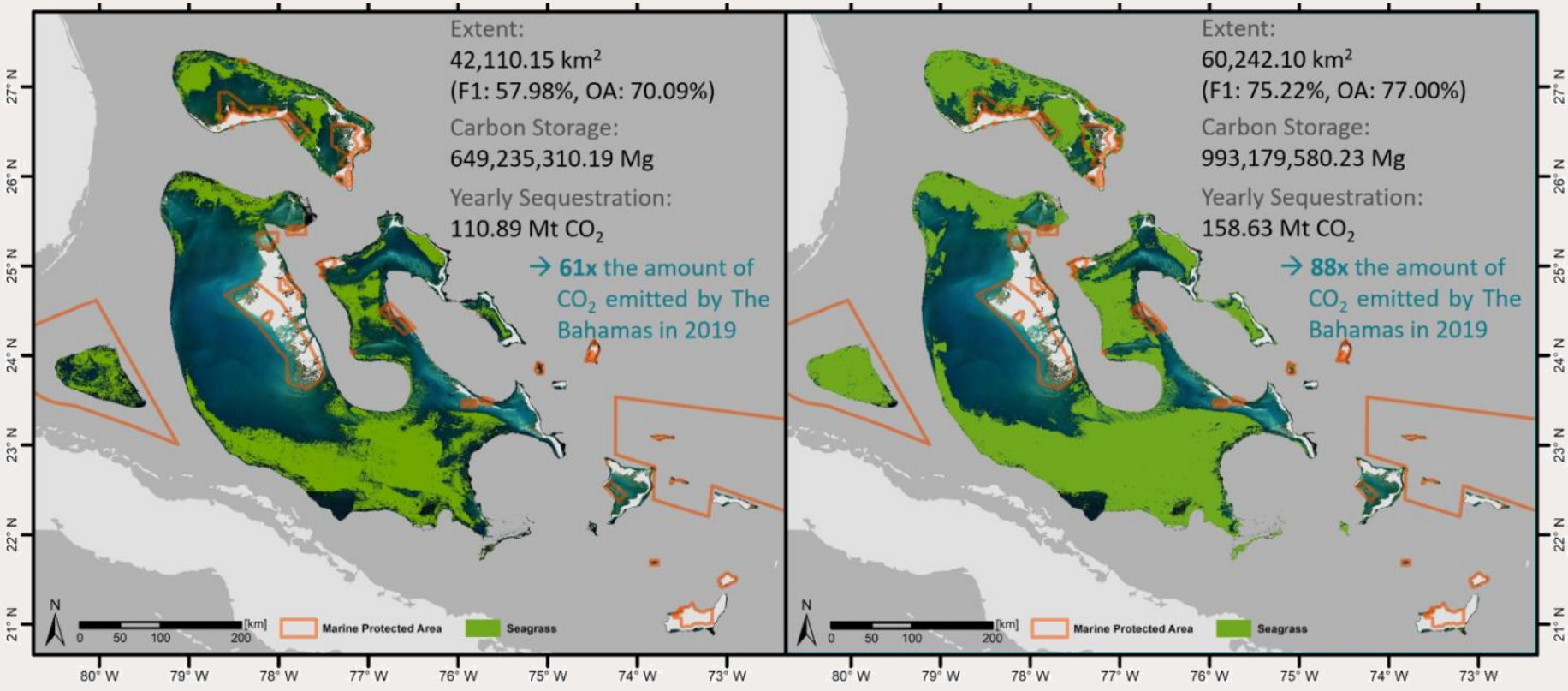
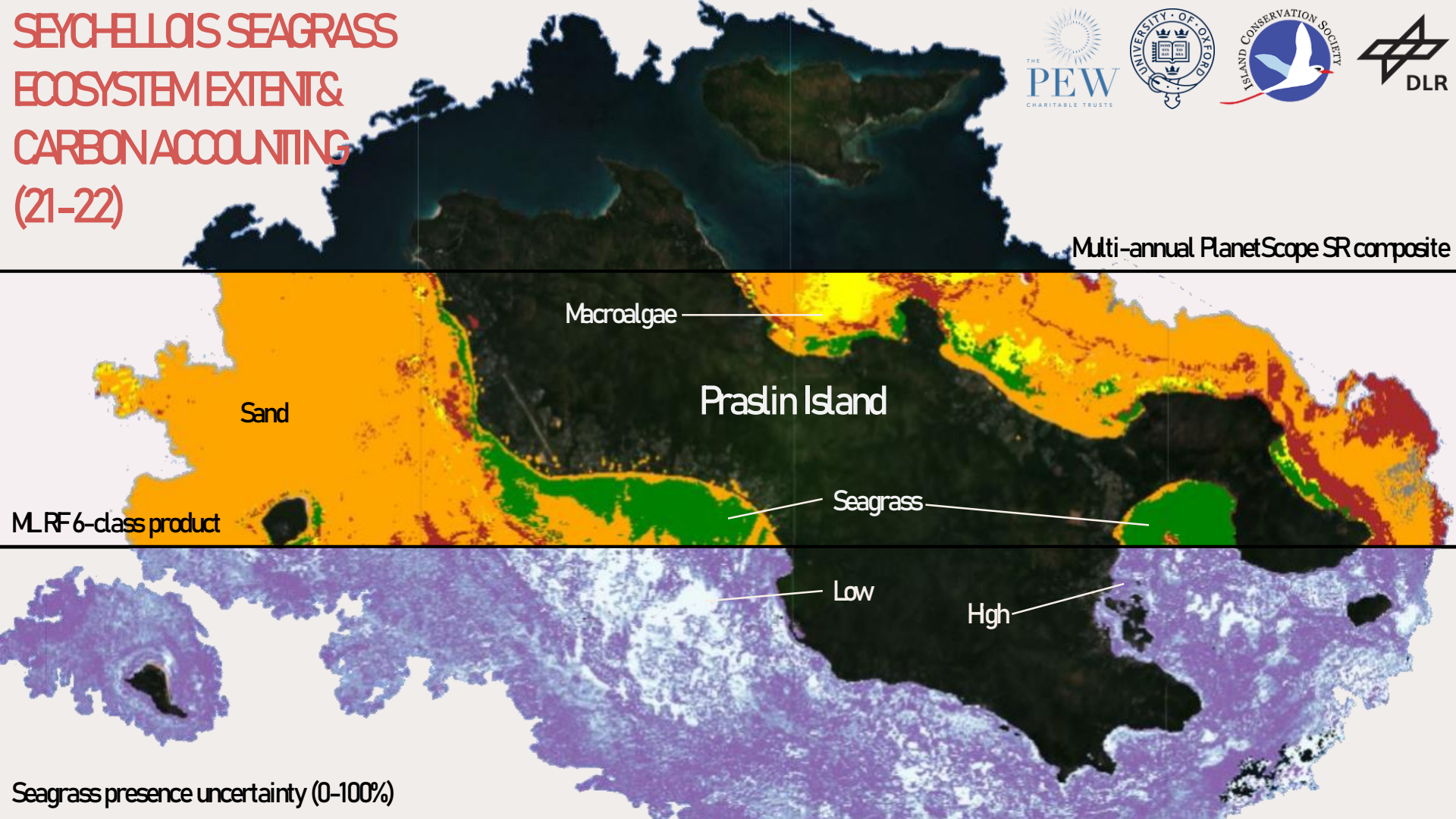
Earth Observation for Ecosystem Accounting: Spatially-explicit national seagrass extent and carbon stock in Kenya, Tanzania, Mozambique, and Madagascar
Accepted for publication in RSEC

BAHAMIAN SEAGRASS ECOSYSTEM EXTENT & CARBON ACCOUNTING (21-22)



SEYCHELLOIS SEAGRASS ECOSYSTEM EXTENT & CARBON ACCOUNTING (21-22)



ESA BIOME COASTAL BIODIVERSITY PROJECT (21-23)

@BiomeProject

ESA Biodiversity+ Precursors call (ESA/AO/1-10527/20/I-EF)

Spatially-explicit seagrass biodiversity accounts (Mozambique and Indonesia)

PML Plymouth Marine Laboratory

UNIVERSITÉ DE NANTES

HYGEOS

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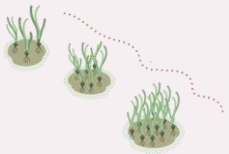
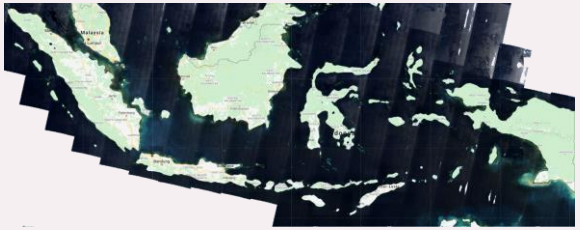
THE CURRENT SHOWSTOPPERS

- Accurate deep seagrass extent accounts



- Lack of fit-for-purpose reference seagrass data



- Remaining challenges in scalable multi-temporal analytics

- Uncertainties in coastal monetary accounting

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

THE FUTURE OF COASTAL ECOSYSTEM ACCOUNTING

- Holistic, spatially-explicit ecosystem accounting of seascapes at national to global scales
- Collaboration with scientists for integration of big field-collected reference data
- Collaboration with policy makers to streamline spatially-aware and cost-effective seascape conservation and restoration
- Collaboration with governments and industry to improve funding and enable transparent high-quality seascape carbon crediting frameworks integrating biodiversity, coastal protection and fish stocks

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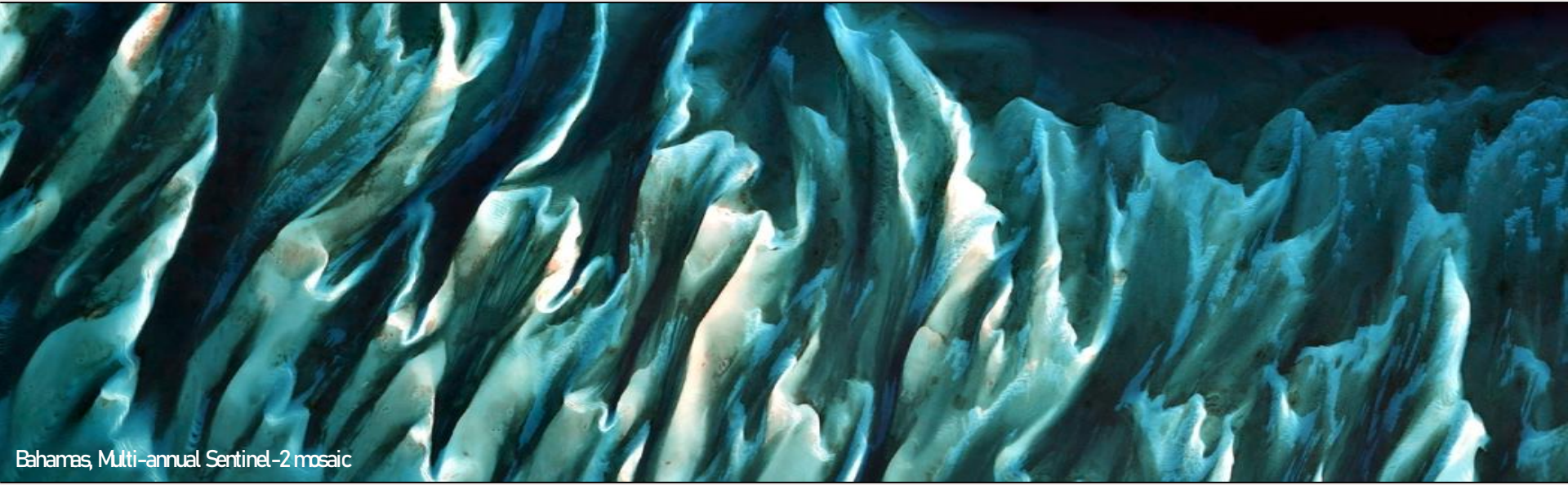
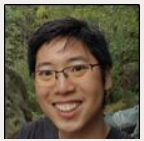


Bahamas, Multi-annual Sentinel-2 mosaic



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