# THE GLOBAL SEAGRASS WATCH SERVICE:

## OPERATIONALIZING BLUE CARBON ECOSYSTEM ACCOUNTING THROUGH CONTEMPORARY EARTH OBSERVATION ANALYTICS

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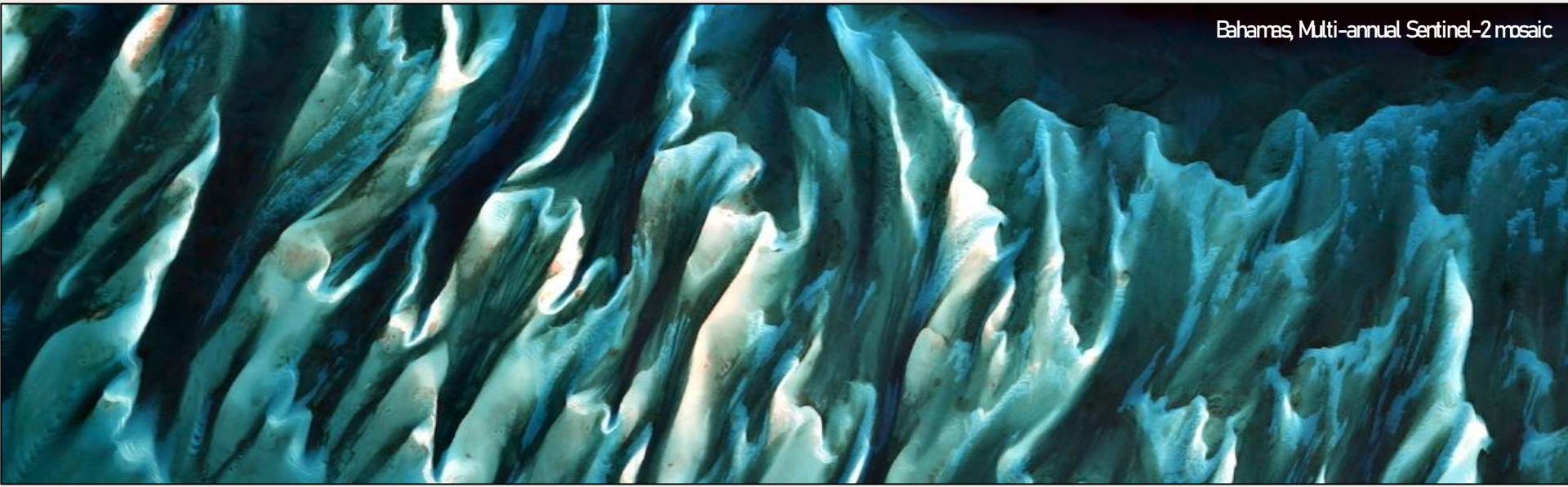

Bahamas, Multi-annual Sentinel-2 mosaic

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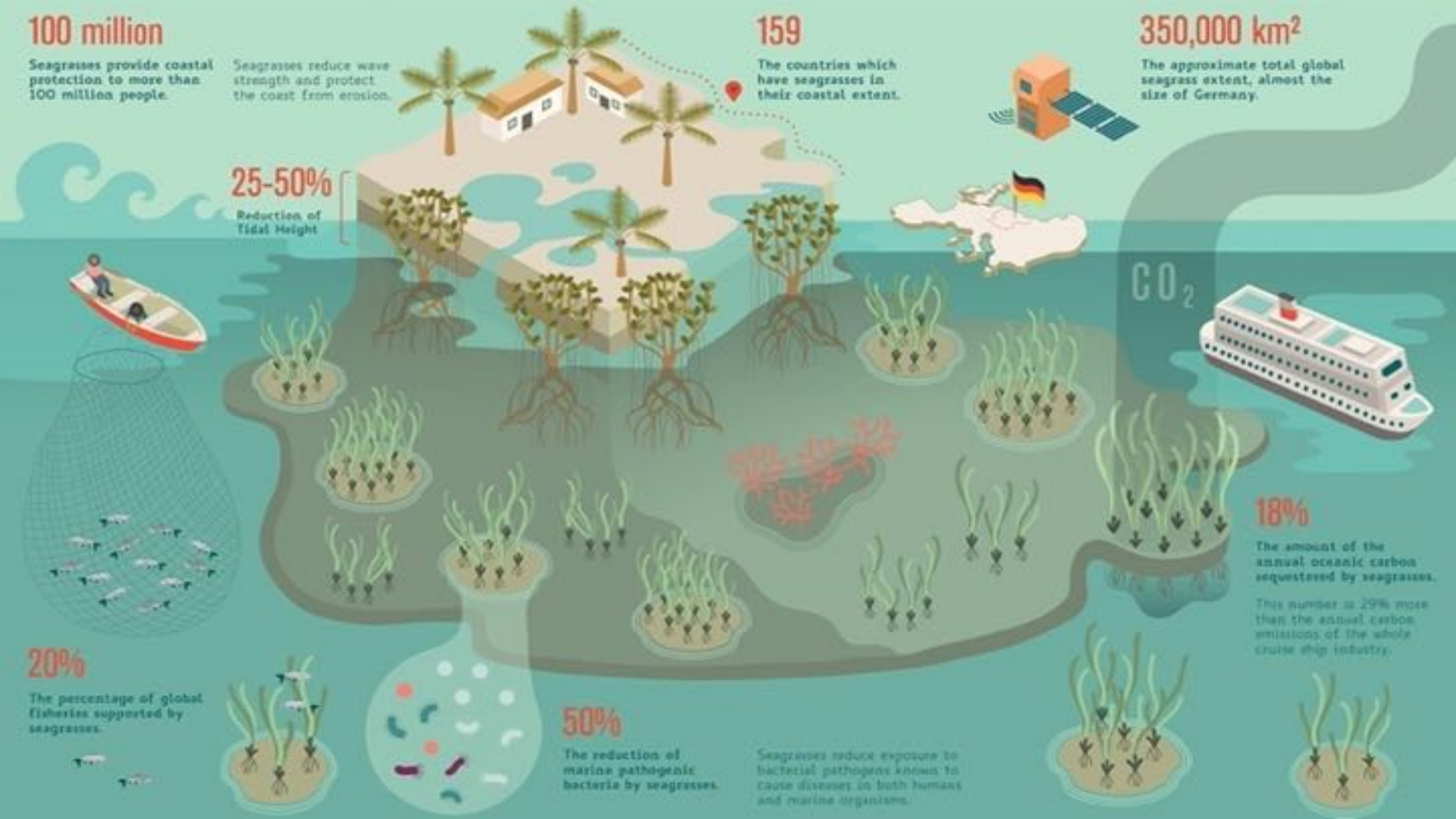
100 million
Seagrasses provide coastal protection to more than 100 million people.
Seagrasses reduce wave strength and protect the coast from erosion.
159
The countries which have seagrasses in their coastal extent.
350,000 km²
The approximate total global seagrass extent, almost the size of Germany.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

# KNOWN UNKNOWNS

- Uncertainty in global seagrass extent: 160,387–4,320,000 $km^2$
  (Fourqurean12; Jayathilake18; McKenzie20; UNEP18)
- Sparsity in spatial coastal ecosystem accounts&accounting frameworks
- Only 17% within MPAs vs 40% of corals & 43% of mangroves (UNEP20)
- Lack of relevant seagrass indicators&tracking of progress of pertinent MEAs

# OUR CLOUD-NATIVE EO4EA RECIPE

**Powerful** Cloud computing

Google Earth Engine

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

Machine Learning

**Big** reference data

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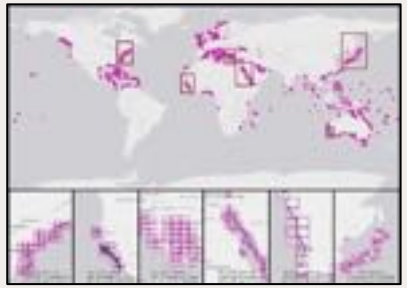
**Spatially-explicit**
seagrass ecosystem extent



**Spatially-explicit**
seagrass ecocystem condition&services

**Per-pixel**
probabilities & uncertainties

# SCALABLE SPATIAL SEAGRASS ECOSYSTEM EXTENT ACCOUNTS

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**22** Mediterranean countries

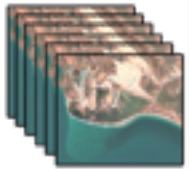
**56,783** km² Mapped seabed area

**>19,000** km² Mapped seagrass area

**72** % Overall accuracy

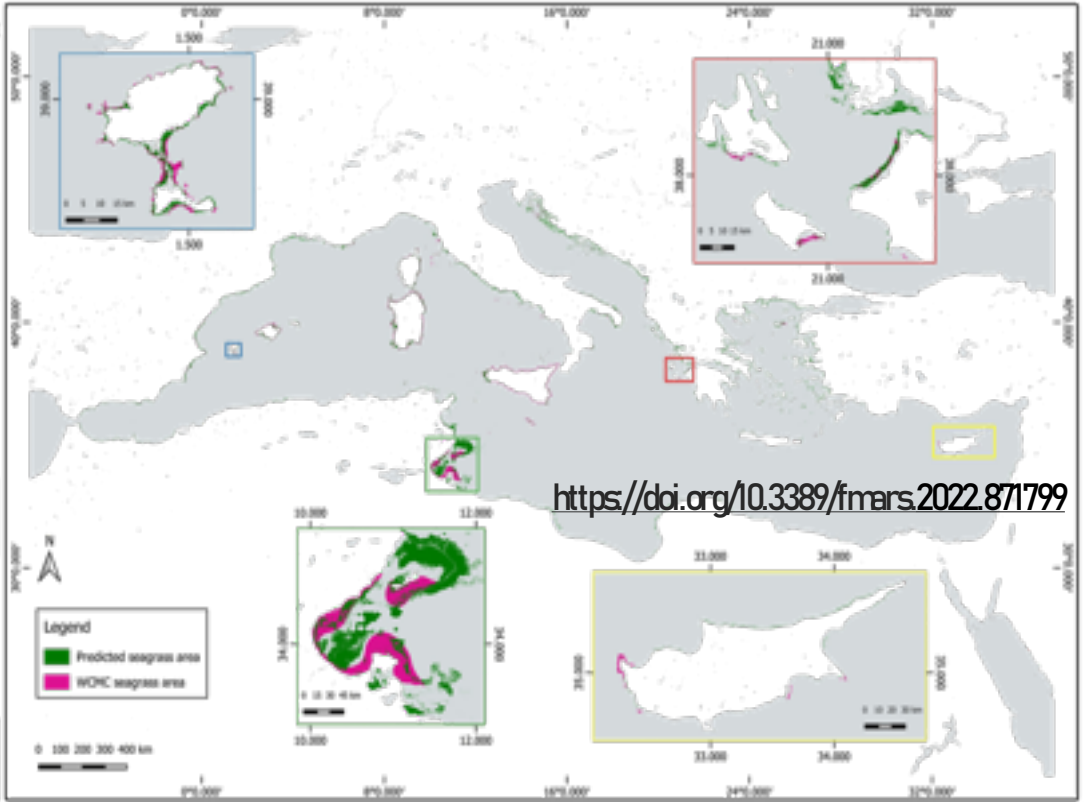
DLR

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



**62,928**
Human-labelled training pixels

**2,480**
Field-collected validation points




https://doi.org/10.3389/fmars.2022.871799

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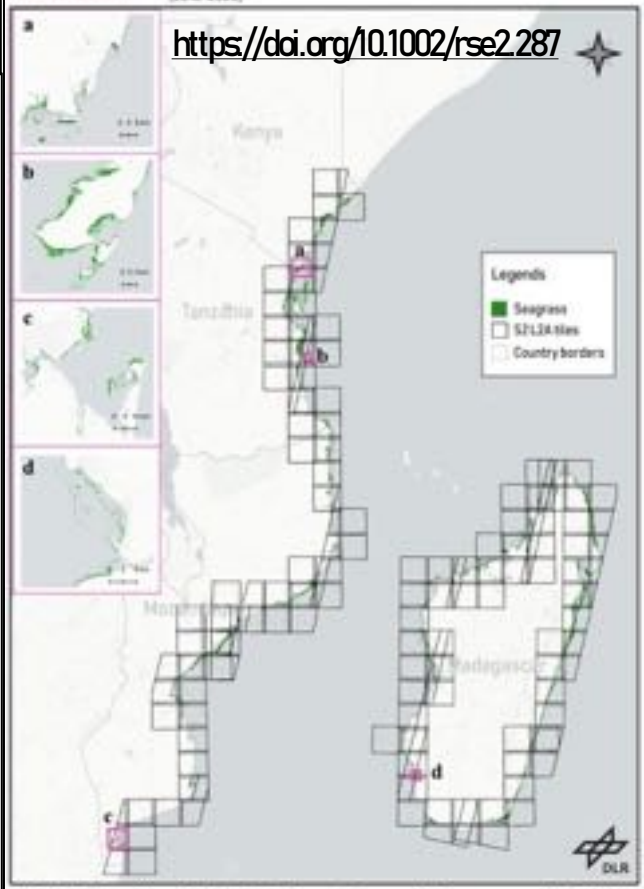
**11,560** 10-m Sentinel-2 L2A image tiles (2018-2020)

**128,000 km²** Mapped seabed area

**84.3%** Overall accuracy

https://doi.org/10.1002/rse2.287




**4,316 km²** Mapped seagrass area

**147.5 Megatons $CO_2$** Stored carbon dioxide in regional seagrass soils

**20,820** reference data points

# ESA BIOMEE COASTAL BIODIVERSITY PROJECT (2021-2023)


@BiomeProject

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

Spatially-explicit seagrass biodiversity accounts (Mozambique&Indonesia)

PML Plymouth Marine Laboratory

UNIVERSITÉ DE NANTES

HYGEOS

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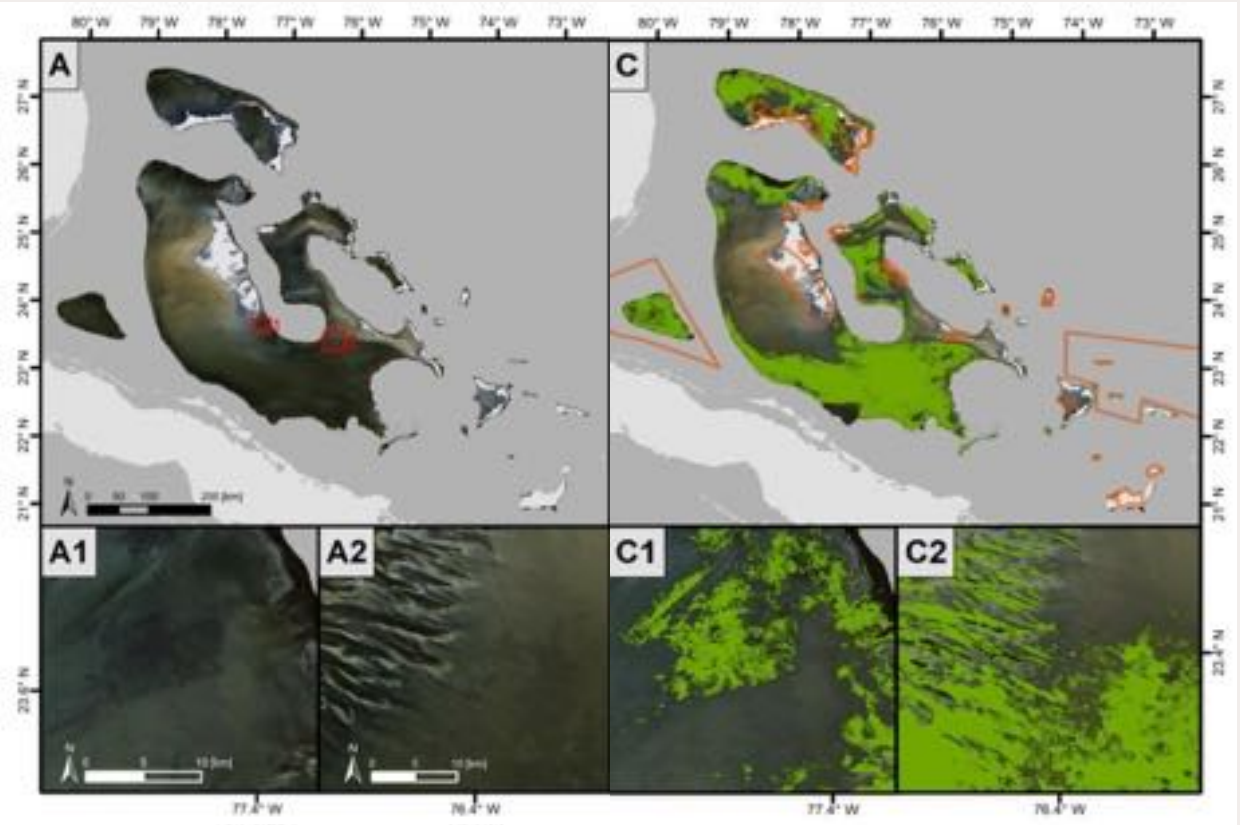
# SEAGRASS ECOSYSTEM EXTENT& BLUE CARBON ACCOUNTS ACROSS THE WORLD'S LARGEST SEAGRASS BED




Up to **46,792 km²**

Up to **68x**

the amount of $CO_2$ emitted by The Bahamas in 2019

Bahamian Seagrass Extent&Blue Carbon Accounting using Earth Observation (Blume et al. 2023)

*Paper under review..stay tuned!*

# REAL-WORLD IMPACT

## THE SEYCHELLES SEAGRASS MAPPING &BLUE CARBON ACCOUNTING PROJECT

First ever actionable nationwide seagrass ecosystem accounting globally

Uptake in national climate and MPA agenda, and blue carbon crediting mechanisms by 2025

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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THE PEW CHARITABLE TRUSTS

# ACHIEVEMENTS TO DATE

| | |
|---|---|
| 28 | Tropical&temperate national seagrass ecosystem extent accounts |
| 306,000 km² | Mapped nearshore shallow seabed area at 5/10 m resolution |
| 76,000 km² | Total spatial seagrass ecosystem extent account area |
| 40% | Mapped global seagrass ecosystem extent |

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# PRESENT CHALLENGES

- ❑ Lack of fit-for-purpose reference seagrass data
- ❑ Lack of temporal scalability (opening accounts)
- ❑ Uncertainties in coastal ecosystem monetary accounting
- ❑ Problematic tracking of progress of relevant MEAs




# FUTURE OPPORTUNITIES

- Holistic, spatial coastal ecosystem accounting from national to global scales
- Fusion of EO data with species distribution, biophysical&economic evaluation modelling to bridge ecological knowledge, economic units&measurable targets of EA
- Quantification of spatial uncertainties of EO products
  = better communication of holistic accounts with scientists&policy makers
  = more accelerated science, policies and actions
- Collaboration with governments&companies to improve funding&enable transparent evidence-based coastal ecosystem accounting including climate change, biodiversity, ecosystems, people

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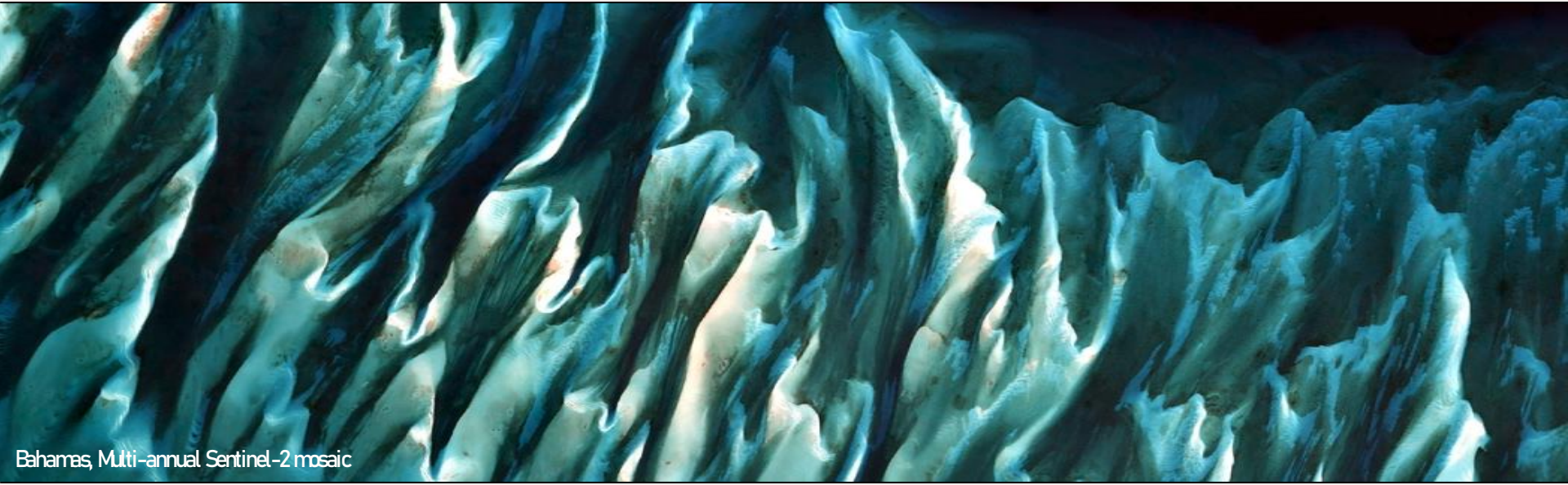

Bahamas, Multi-annual Sentinel-2 mosaic

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