A full cloud-native dive into regional-scale seagrass mapping in the Mediterranean using Sentinel-2 multitemporal data

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Global Seagrass Watch

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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%

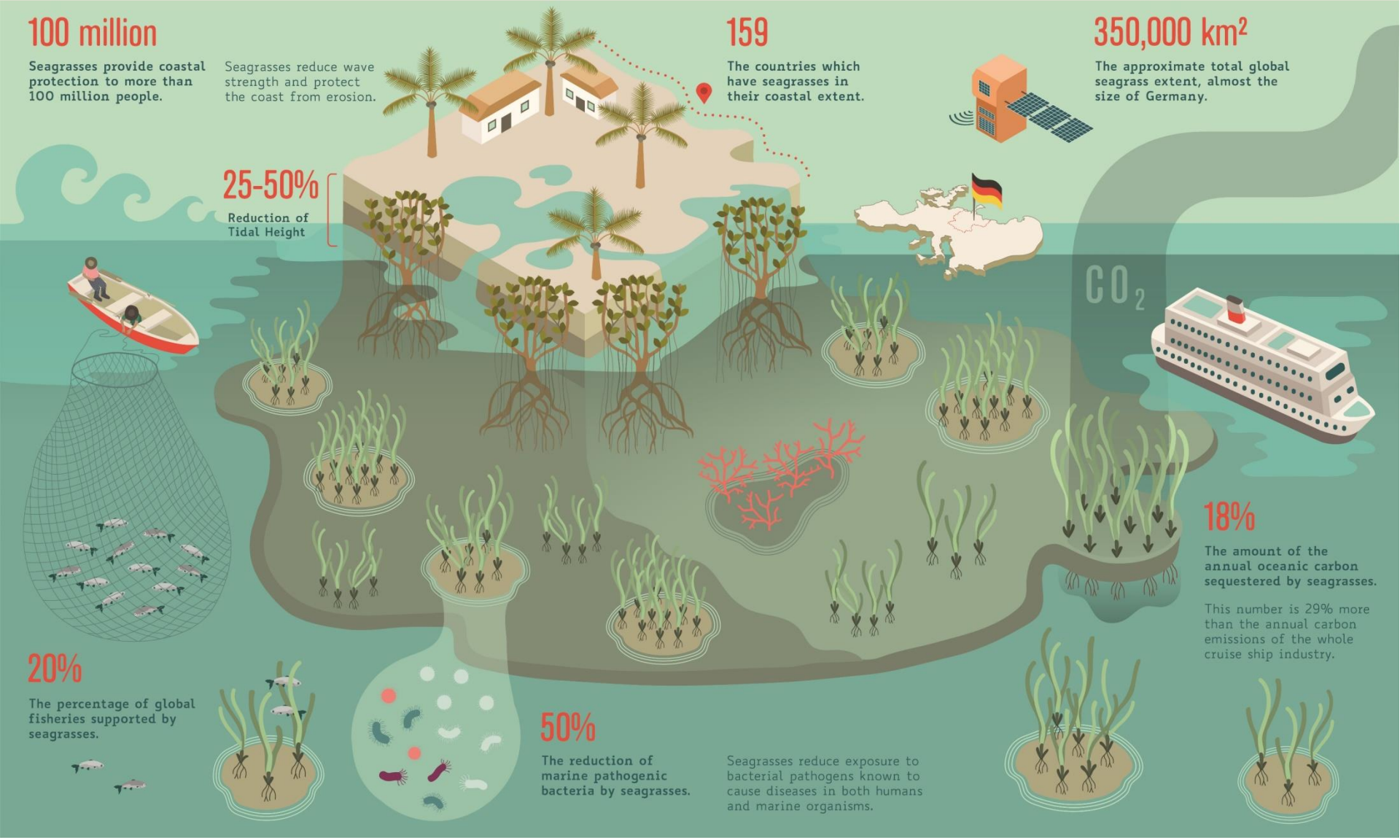
Reduction of Tidal Height

159

The countries which have seagrasses in their coastal extent.

350,000 km²

The approximate total global seagrass extent, almost the size of Germany.



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%

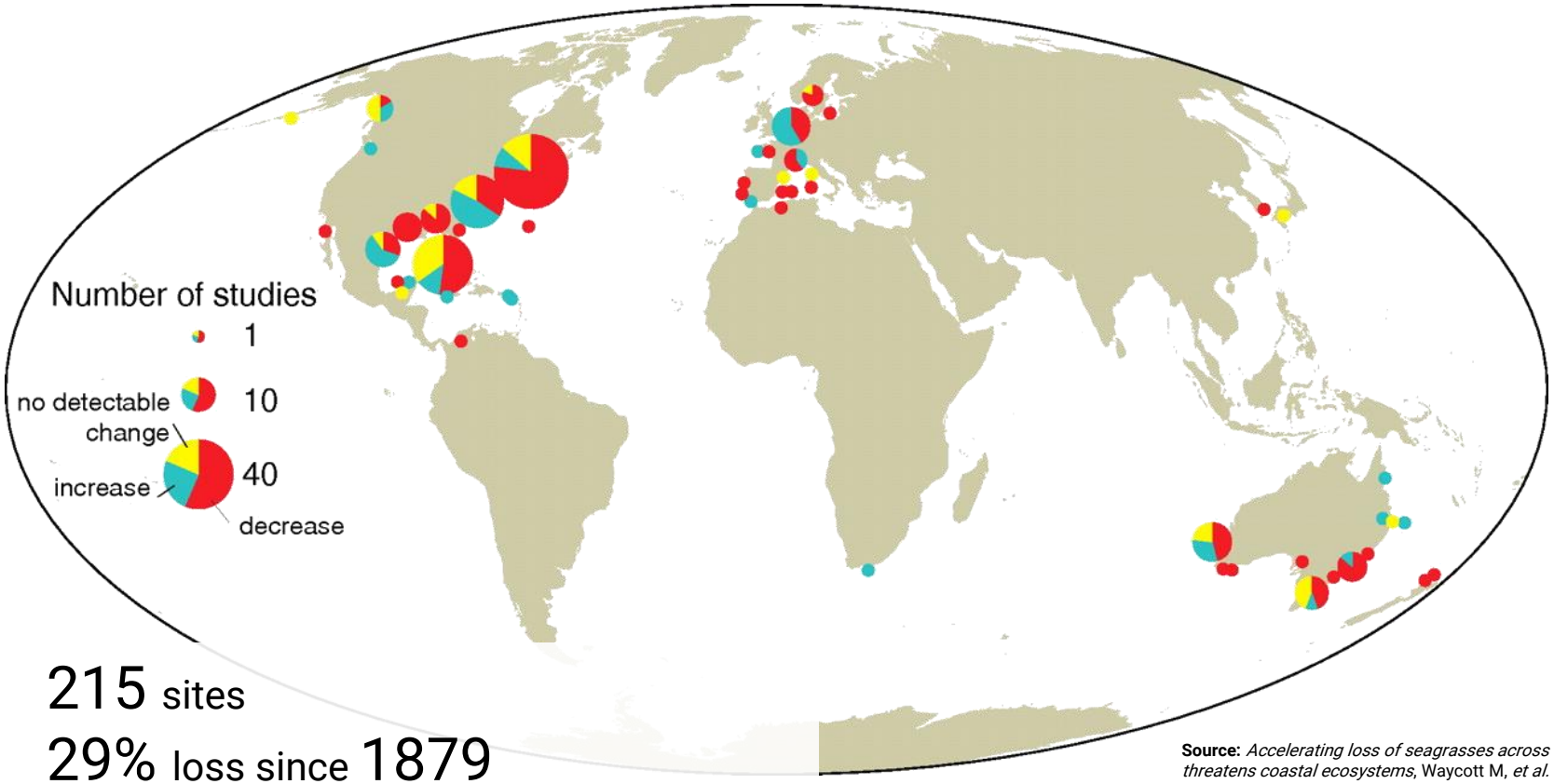
The percentage of global fisheries supported by seagrasses.

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.

Rapid & global loss of seagrass



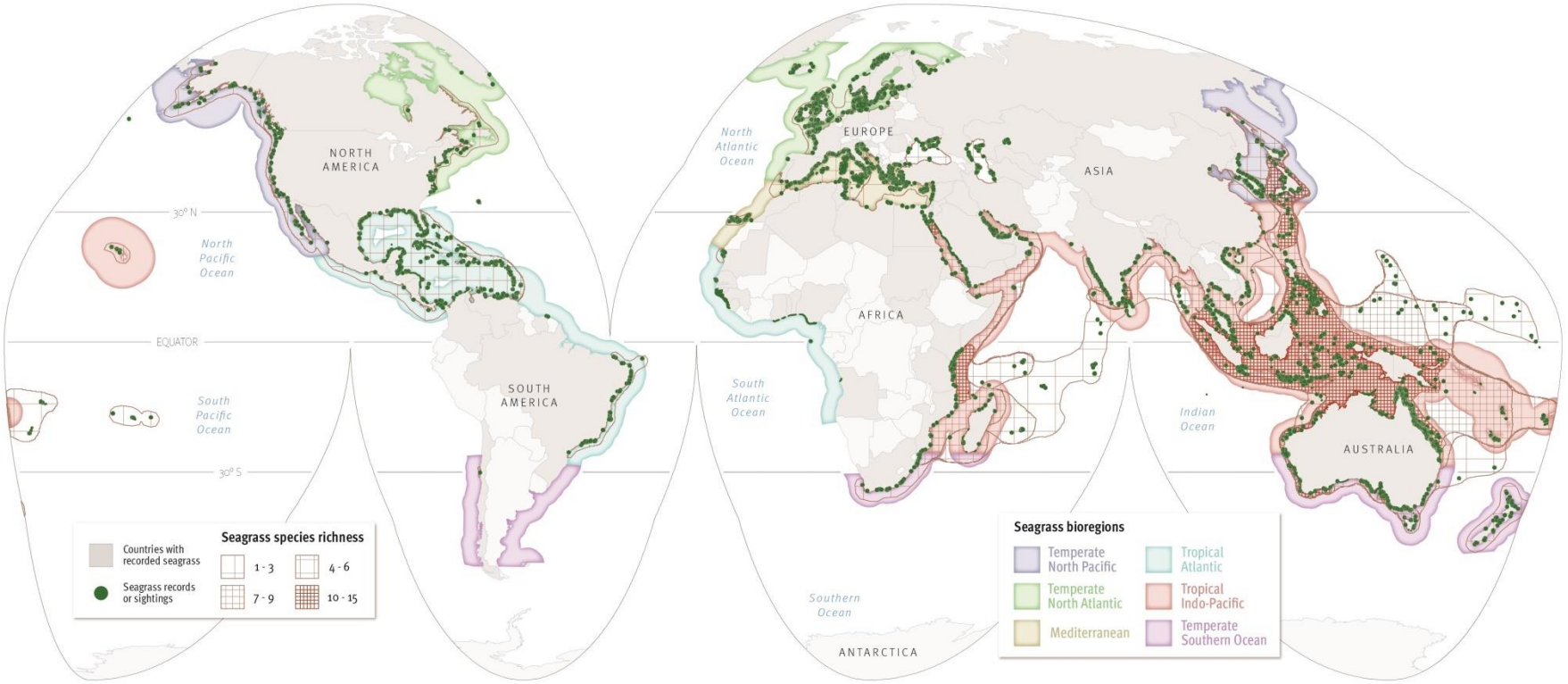
215 sites

29% loss since 1879

3 seagrass bioregions poorly represented

Source: *Accelerating loss of seagrasses across the globe threatens coastal ecosystems*, Waycott M, *et al.* (2009)

Seagrass Datasets



Sources: UNEP-WCMC, Short FT (2018), Global distribution of seagrasses (version 6.0). Green EP, Short FT (2003), World atlas of seagrasses. Short FT, et al. (2007), Global seagrass distribution and diveristy: a bioregional model.

Map produced by Levi Westerveld/GRID-Arendal (2019).
Projection: Goode Homolosine

Seagrass Datasets

Analysis Ready Dataset (ARD)

1. Expanded spatial extent
2. Processing large datasets
3. Monitoring changes (temporal)

1. Easy scalability
2. Cloud computing capabilities
3. Multitemporal analytics

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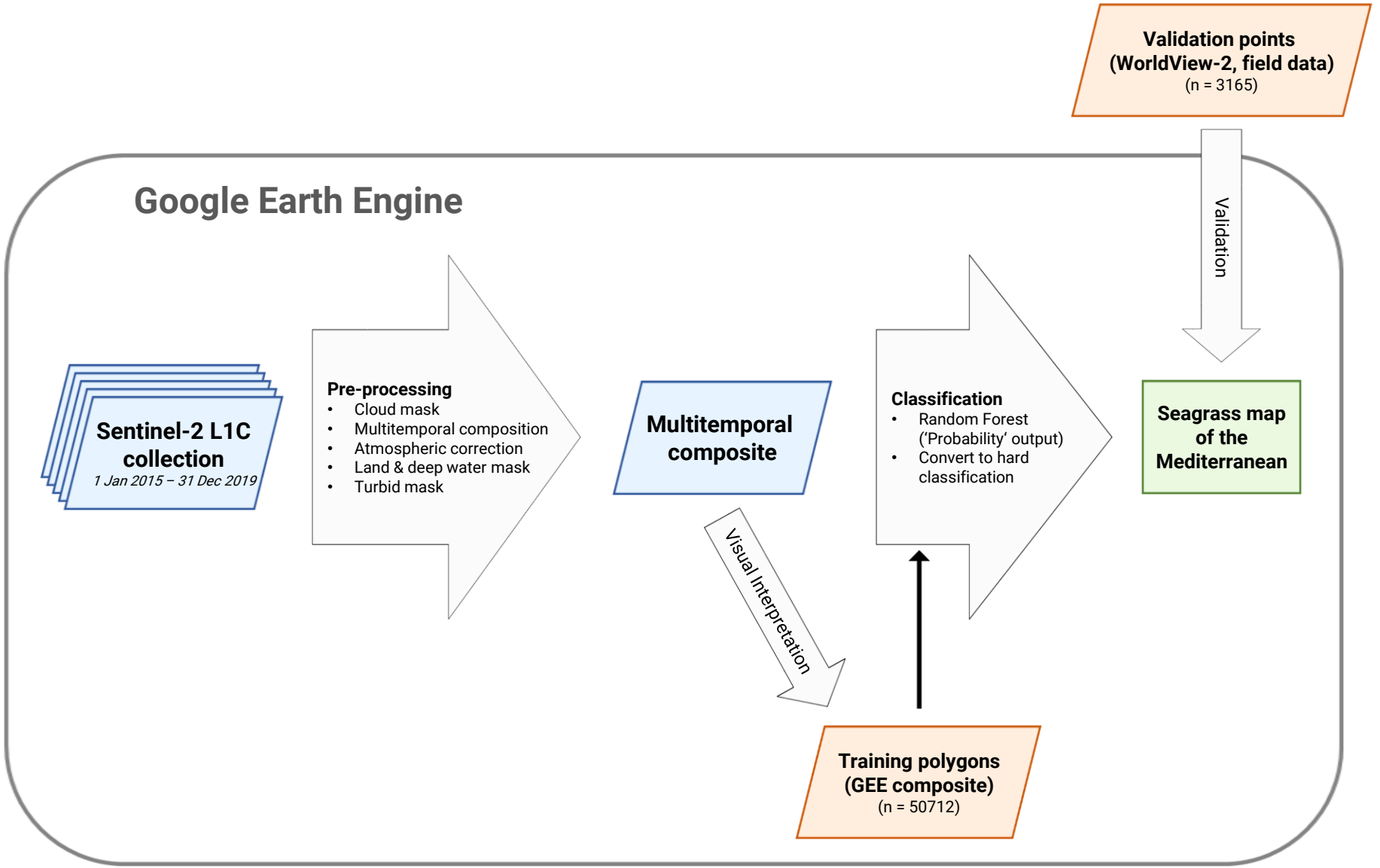
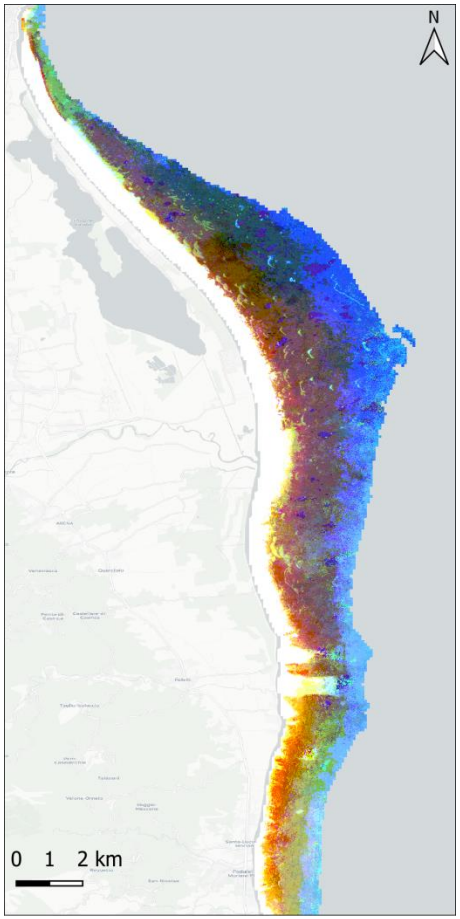

Validation points
(WorldView-2, field data)
(n = 3165)
Validation
Google Earth Engine
Sentinel-2 L1C collection
1 Jan 2015 – 31 Dec 2019
Pre-processing
• Cloud mask
• Multitemporal composition
• Atmospheric correction
• Land & deep water mask
• Turbid mask
Multitemporal composite
Classification
• Random Forest ('Probability' output)
• Convert to hard classification
Seagrass map of the Mediterranean
Visual Interpretation
Training polygons
(GEE composite)
(n = 50712)

Statistics

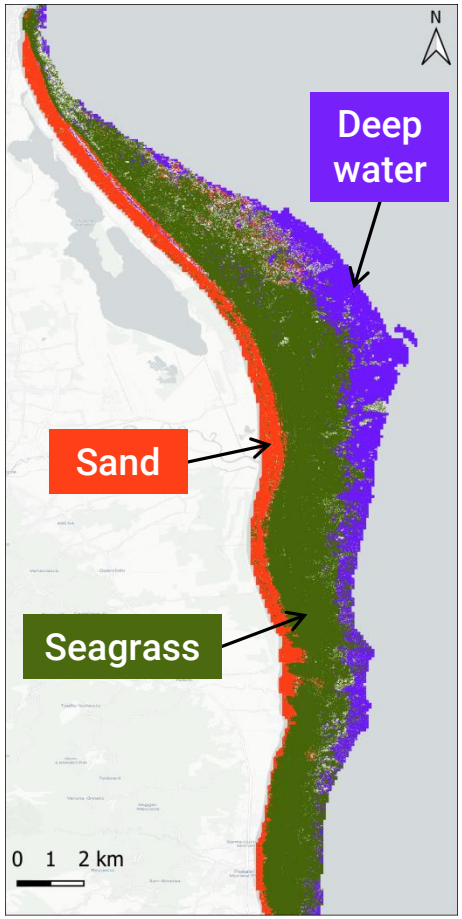
Scalability	
No. of tiles used	*~280,000*
Total area of basin covered	*~56,000 km^2*
Estimated total seagrass area	*~19,000 km^2*

Accuracy	
Seagrass PA	*55.0 %*
Seagrass UA	*61.8 %*
Overall accuracy	*72.1 %*

Bastia, Corsica, France

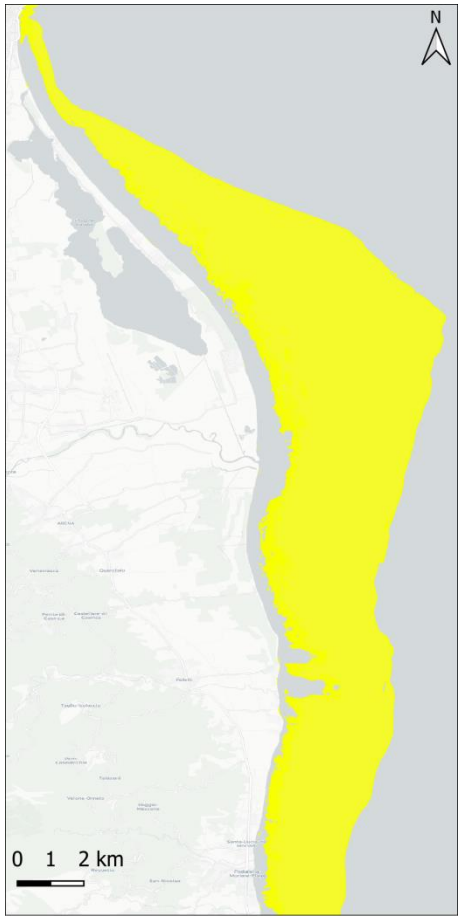


RGB composite



Soft to hard classification

Seagrass map

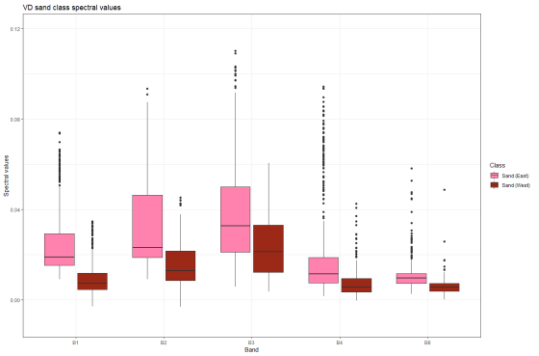


UNEP-WCMC seagrass

Source: Own work (2020)

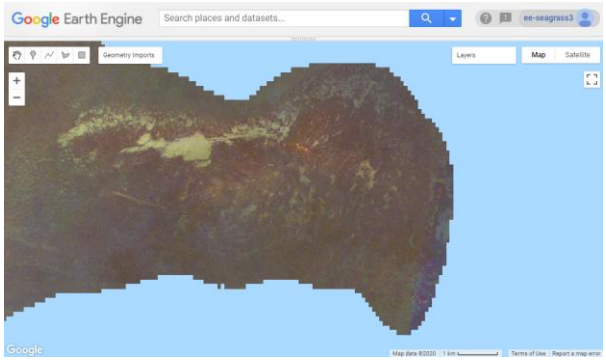
Challenges

1. Spectral normalisation (regional)



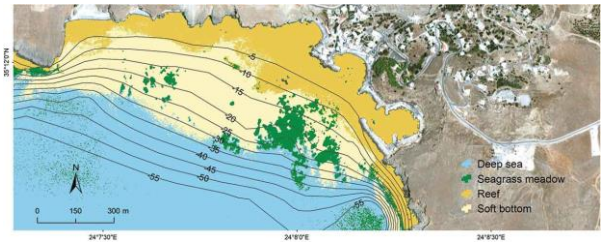
Source: Own work (2020)

2. Spectral artifacts (local)



Source: Own work (2020)

3. Optical depth



Source: *Mapping coastal marine habitats and delineating the deep limits of the Neptune's seagrass meadows using very high resolution Earth observation data*, Poursanidis D, *et al.* (2018)

Works

1. GEE App showcase

Seagrass meadows of Corsica (France)

https://leechengfa.users.earthengine.app/view/geo-for-good-2020-mapping-mediterranean-seagrasses

2. Work in progress

Cloud-native advances in Earth Observation reveal the pan-Mediterranean extent of the *P. oceanica* seagrass ecosystem

Traganos, Lee, Poursanidis *et al.* (2020). Manuscript in preparation.

3. Future ventures

- Carbon stock estimates
- Change detection
- Species identification

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Thank you for your attention.

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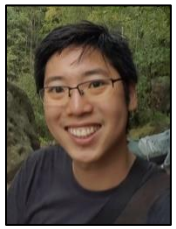

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