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A FULL CLOUD-NATIVE DIVE INTO BIOREGIONAL-SCALE SEAGRASS MAPPING IN THE MEDITERRANEAN USING SENTINEL-2 MULTITEMPORAL DATA

German Aerospace Center

GLOBAL



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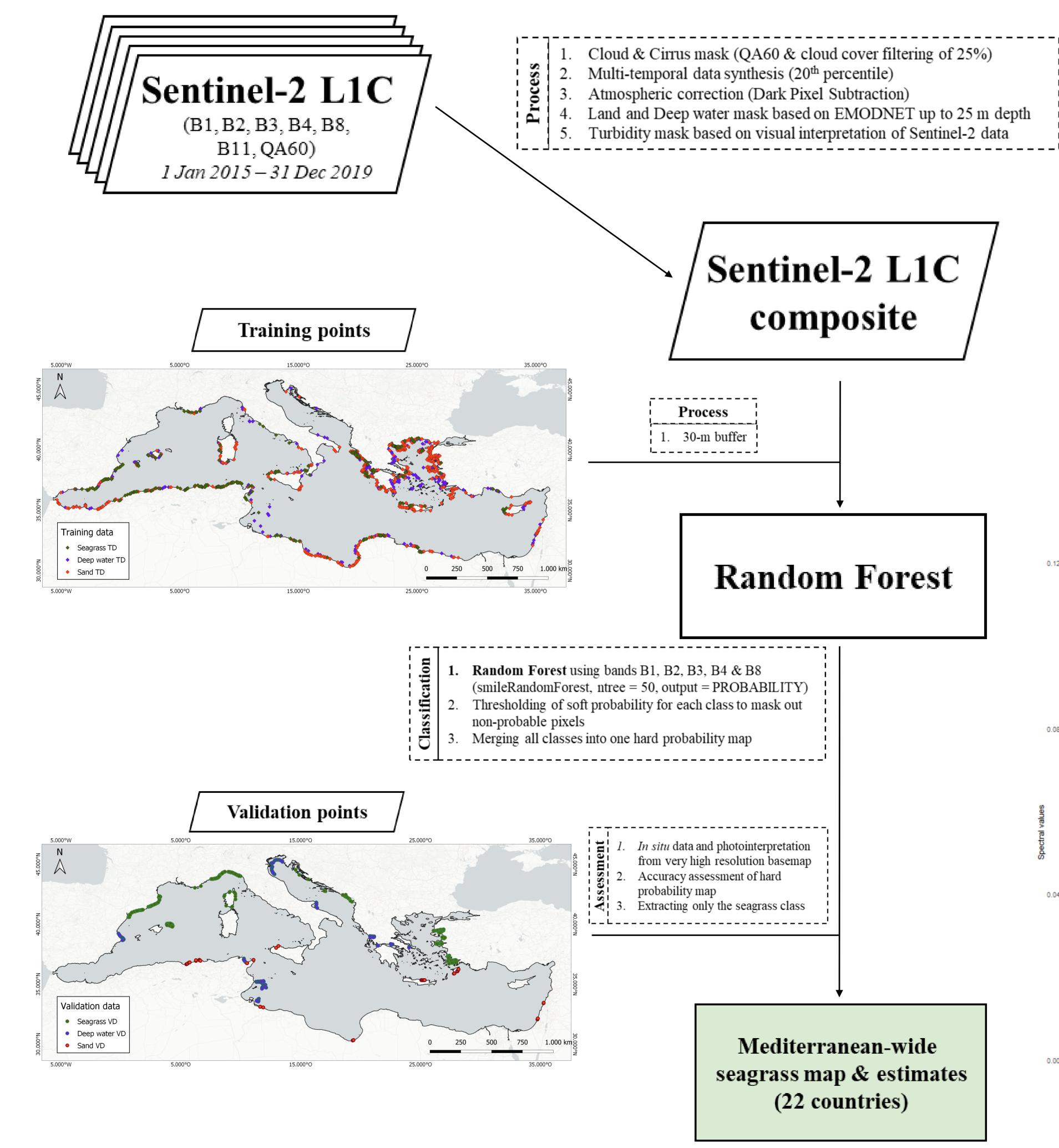
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INTRODUCTION

The seagrass *Posidonia oceanica* is the main habitat-forming species of the coastal Mediterranean, providing millennial-scale ecosystem services including habitat provisioning, biodiversity maintenance, food security, coastal protection, and carbon sequestration. Yet, its slow growth and the extreme projected temperature and sea-level rise due to climate change increase the risk of reduction and loss of these services. Currently, there are knowledge gaps in its basin-wide extent, therefore accurate and efficient mapping of its distribution and trajectories of change is needed. Here, we leverage on recent advances in Earth Observation — cloud computing, open satellite data, and machine learning — with field observations through a cloud-native Earth Observation framework to estimate the pan-Mediterranean extent of P. oceanica.

Workflow



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Background image: Photograph by Gronk, distributed under the GNU Free Documentation License. Url at https://commons.wikimedia.org/wiki/File:Posidonia.JPG.

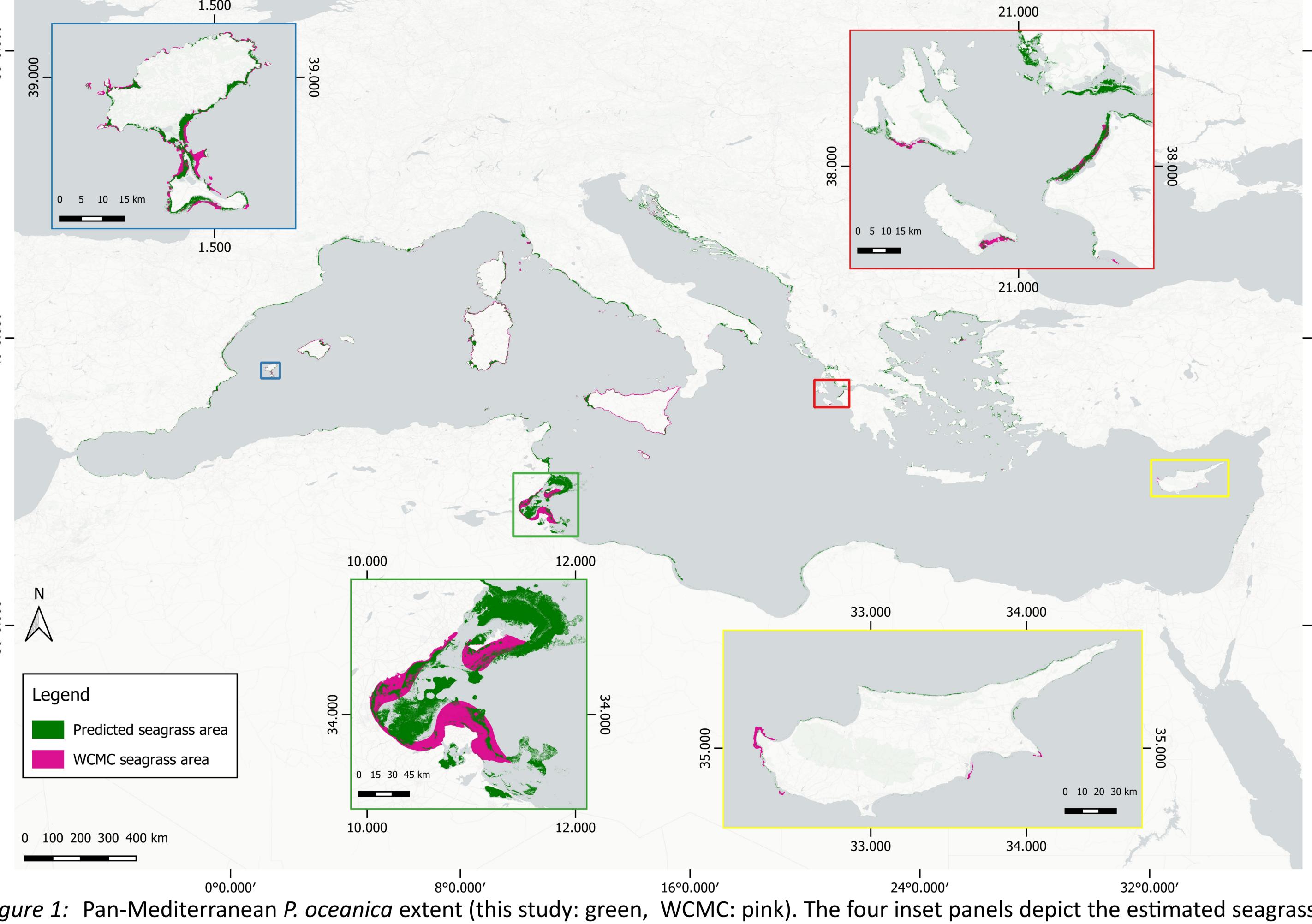


Figure 1: Pan-Mediterranean P. oceanica extent (this study: green, WCMC: pink). The four inset panels depict the estimated seagrass extents in Ibiza and Formentera, Spain (blue inset), Gulf of Gabes, Tunisia (green inset), NW Peloponnese and South Ionian Sea, Greece (red inset), and the country scale of Cyprus (yellow inset).

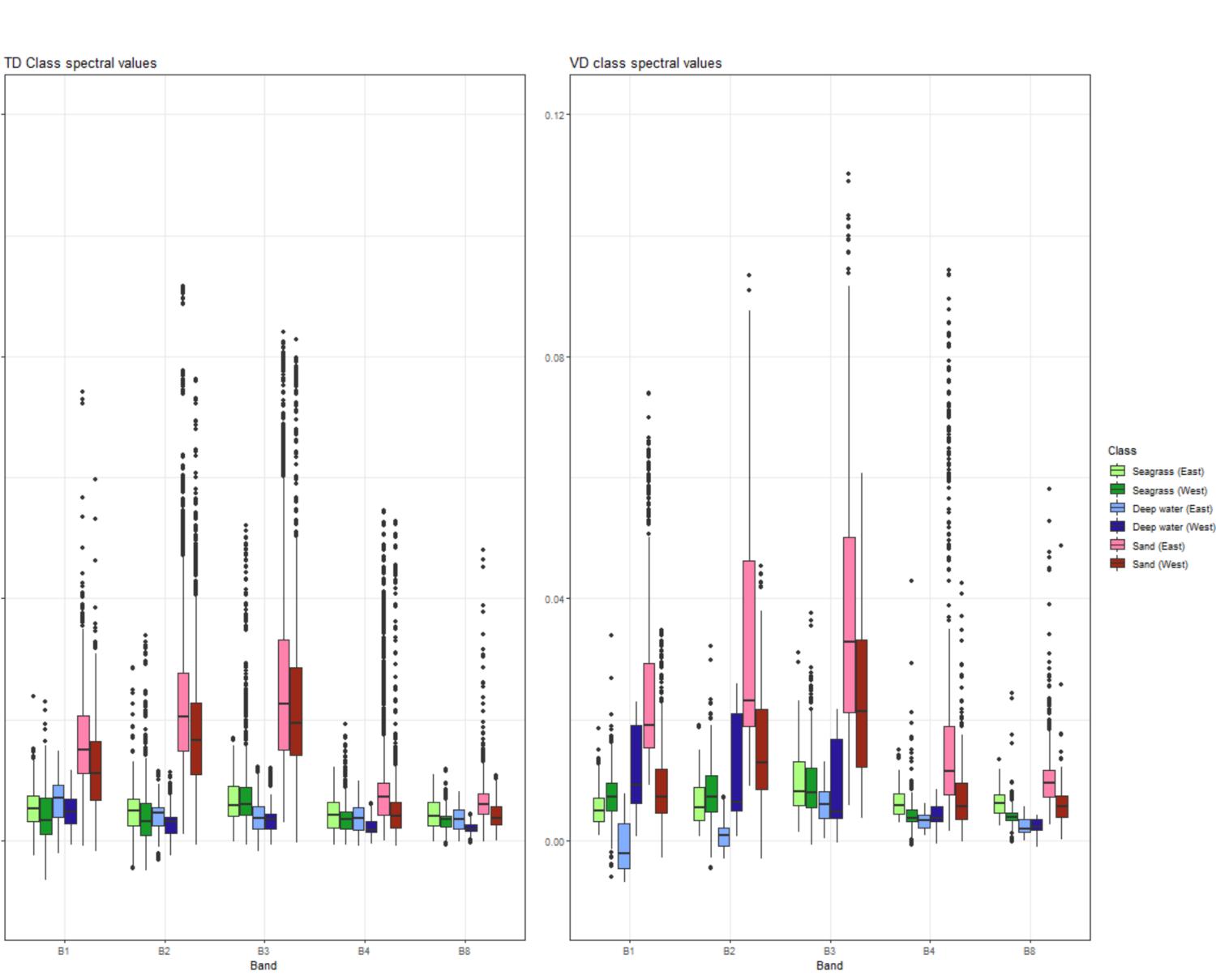


Figure 2: Boxplots showing the spectral ranges of the training and validation datasets across regions (east: brighter hue, west: darker hue) and three classes (seagrass: green, water: blue, sand: red).

Table 1: Predicted area of P. oceanica by country.

Country	Predicted seagrass area (km)	Country	Predicted seagrass area (km)	
Albania	149.56	Libya	622.03	
Algeria	167.91	Malta	29.44	
Bosnia & Herzegovina	6.90	Monaco	0.41	
Croatia	2,029.99	Montenegro	146.62	
Cyprus	44.45	Morocco	148.03	
Egypt	2.96	Slovenia	0.00021	
France	900.28	Spain	1,480.88	
Greece	2,877.78	Syria	0.00	
Israel	10.43	Tunisia	6,369.05	
Italy	3,261.23	Turkey	740.59	
Lebanon	26.94	UK (Gibraltar)	4.20	

RESULTS & DISCUSSION

Table 2: Table showing the producer's accuracy (PA), user's accuracy (UA) and overall accuracy (OA) for the West and East basins separately, as well as the combined basin.

	West basin		East basin		Entire basin	
	PA (%)	UA (%)	PA (%)	UA (%)	PA (%)	UA (%)
Seagrass	60.59	69.12	40.20	43.39	55.02	61.80
Deep water	27.36	71.23	0.00	0.00	14.86	68.42
Sand	83.88	61.21	99.80	95.27	94.75	82.42
OA (%)	64		79		72	

- A total of **279,186** Sentinel-2 images (2015 to 2019), **62,928** human-labelled training pixels, and 2,480 independent & field-based validation points were used.
- We mapped 19,020 km² of *P. oceanica* meadows up to 25 m depth in 22 countries (Figure 1 & Table 1), across a total seabed area of **56,783** km².
- Owing to spectral dissimilarities between the Eastern and Western basins (Figure 2), the region was split into two before classification. Nonetheless, we were still unable to avoid the over—and underestimation of the seagrass class.
- Our overall accuracy for the entire basin was 72% (Table 2).

FUTURE STEPS

With the availability of suitable reference data:

- .. Globally-scalable high-resolution seagrass extent inventories
- 2. Change detection and monitoring
- 3. National seagrass blue carbon stocks to inform and strengthen the Nationally Determined Contributions of countries, as well as contribute to the Sustainable Development Goals, Aichi Biodiversity Targets, etc.

CONCLUSION

- 1. We created the first data-driven cloud-native mapping at an entire bioregional scale from a single, harmonised data source at 10 m via multitemporal analytics.
- 2. Our map of the pan-Mediterranean basin achieved an overall accuracy of 72%.
- 3. Future steps will be aligned towards providing more information for sustainable development and conservation goals.

Promoted talk:

- "Serverless is more for blue carbon" Dr. Dimosthenis Traganos
- 27 June (Sun), 15:30 (GMT), Session SS14

Check out our map on the Google Earth **Engine App here!**



Traganos, D., Lee, C. B., Poursanidis, D., Čižmek, H., Deter, J., Mačić, V., Montefalcone, M., Pergent, G., Pergent-Martini, C., Ricart, A. M., Reinartz, P. (2021). Earth Observation advances reveal the bioregional extent of the Posidonia oceania seagrass ecosystem. Manuscript submitted for publication.