MAKING SEAGRASSES GREAT AGAIN

Mediterranean seagrasses are overlooked and regressed, yet they comprise the largest ocean carbon sinks. Here, we present how we are exploiting Sentinel-2 imagery to monitor Mediterranean seagrasses.

The challenge

In the era of human-induced climate change, Mediterranean seagrasses – underwater flowering plants – absorb and store carbon dioxide, the so-called "blue carbon". Posidonia oceanica which is iconic and endemic in the Mediterranean, is indeed the species with the largest stocks of blue carbon amongst all seagrasses. It could therefore act as a natural carbon capture technology, mitigating climate change. Despite being protected by EU legislation, Mediterranean seagrasses are declining. The unprecedented growth of Earth Observation is deemed necessary to resolve their existing trends, unravel data issues and allow for their better management and conservation in a time- and cost-efficient fashion.

The space based solution

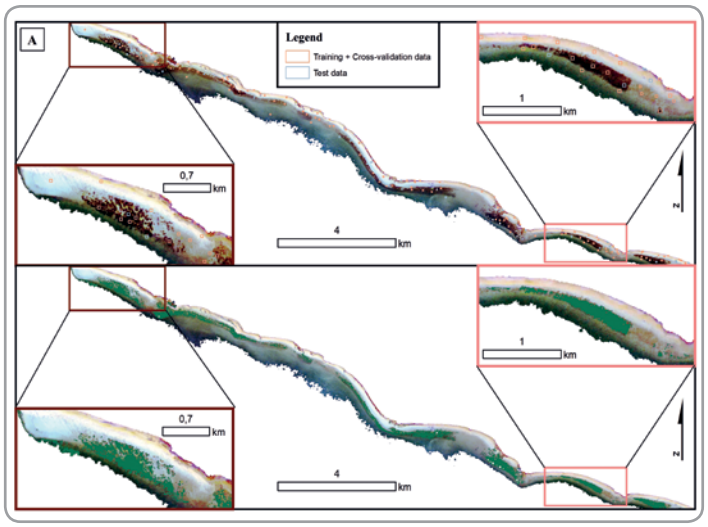
Recent advances in Earth Observation in terms of optical satellite technology, cloud computing and machine learning algorithms have created the perfect storm which could aid high spatio-temporal, large-scale mapping and monitoring of Mediterranean seagrasses. More specifically, DLR and FORTH join forces towards a large-scale P. oceanica seagrass mapping and monitoring approach using Copernicus Sentinel-2 data and existing extensive field data in the entire extent of the Greek Seas (Figure 1). The enhancement of the Sentinel-2 coastal aerosol band from 60-m/ to 10-m/pixel (Figure 2) is integral in our methodology due to the resulting greater spatial information and depth range. In fact, employing this enhanced band, we mapped P. oceanica seagrass beds up to depths of 32 m in the south of Crete.

We also apply a series of corrections to decrease the interferences of the atmosphere, water surface and water column on the Sentinel-2 data, hence increasing the accuracy of the machine learning classifications.

Benefits to Citizens

Our recent satellite-based interranual change detection in the Thermaikos Gulf (NW Aegean Sea) revealed a decreasing trend in the area of P. oceanica seagrass habitat. Based on its ecological value, this translates into a financial loss of 19,264 €/yr and a further impact on the fishery grounds of the Thermaikos which exhibit the second largest fishing catch quantity in all Greek Seas. The degradation observed could be attributed to coastal development, eutrophication, but also to climate change in the broader area of the Gulf.

Generally, the twin Sentinel-2 satellites could mitigate Mediterranean seagrass degradation in a time- and cost-efficient fashion by identifying problematic areas. This would in turn lead to the successful protection of the plethora of important ecosystem services that these underwater habitats provide – carbon capture,



Machine learning-based classification of Posidonia oceanica seagrass meadows integrating Sentinel-2 and field data, NW Aegean Sea.
Credit: Contain modified Copernicus Sentinel data [2017]

Thematic Area: BIODIVERSITY AND ENVIRONMENTAL PROTECTION

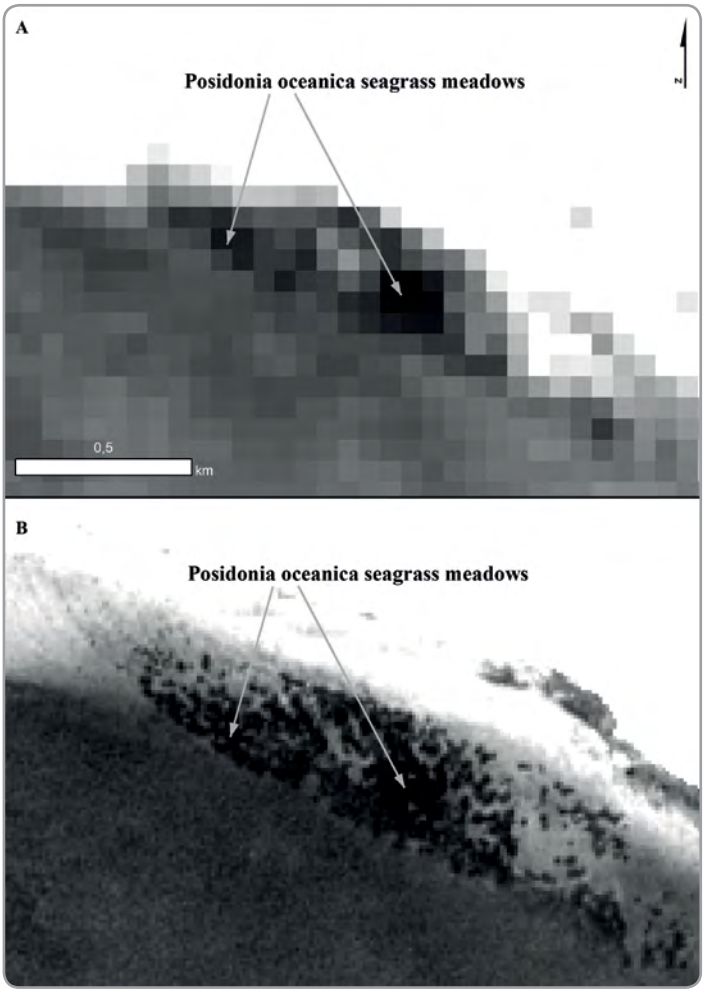
Region of Application: SAMARIA NATIONAL PARK, CRETE

Sentinel mission used: S2

Copernicus Service used: –

Usage Maturity Level: 1

coastal erosion protection, nursery and fishing grounds – through the creation of Marine Protected Areas.



Enhancement of Sentinel-2 coastal aerosol band 1 from 60m/pixel (A) to 10m/pixel (B) with indicated location of P. oceanica seagrass.
Credit: Contain modified Copernicus Sentinel data [2017]

> "Sentinel data can support scientists and decision makers with coastal habitat monitoring and conservation."
>
> ***Antonis Barnias, Samaria National Park***

Outlook to the future

In the near future, we envisage integrating our algorithms with the recently launched Google Earth Engine and the soon-to-be-launched DIAS (Copernicus Data and Information Access Services) – both cloud computing platforms – and develop workflows which we could adjust both in space and time to map and monitor seagrasses basin-wide (e.g. Mediterranean Sea) but also globally. As we are moving from Big Data to Big Indicators – where highly accurate, continuously produced, global-scale indicators monitor the health of the most vital ecosystems on Earth – we hope that our workflows will galvanise the incorporation of seagrasses to this era during which, every physical change will be indexed and related biophysical parameters, including carbon sequestration of seagrasses, will be accurately mapped, naturally, given the availability of relevant field data.

Acknowledgements

We thank the European Commission and ESA for providing Sentinel-2 data through the Copernicus Open Access Hub.

Dimosthenis Traganos, Peter Reinartz[1],
Dimitris Poursanidis, Nektarios Chrysoulakis[2]
1. German Aerospace Center (DLR), Remote Sensing of Technology Institute, Germany,
2. Foundation for Research and Technology, Hellas, Institute of Applied and Computational Mathematics, Greece.
Email: dimosthenis.traganos@dlr.de
peter.reinartz@dlr.de
dpoursanidis@iacm.forth.gr
zedd2@iacm.forth.gr

ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication "**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**", 2018, Edited by NEREUS, the European Space Agency and the European Commission.
The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains.
The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.
Funded by the European Union, in collaboration with NEREUS. Paging, printing and distribution funded by the European Space Agency.