

SENTINEL-2 SUPPORTS COASTAL MANAGEMENT FOR OPTIMISED DECISION MAKING

Novel applications ranging from monitoring dredged induced turbidity plumes to tuna fishing management in SW Spain

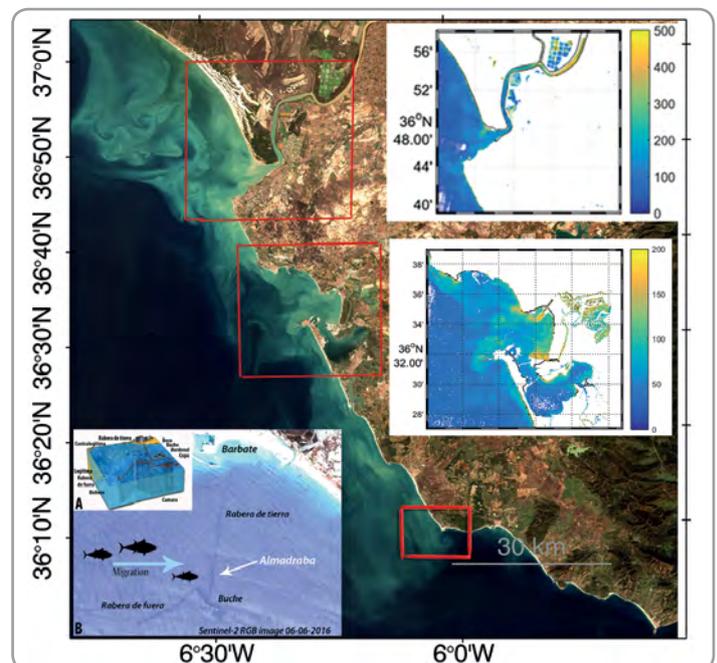
The challenge

Monitoring the complex variations in water quality and understanding the impact of environmental change on the Gulf of Cadiz ecosystem (SW Iberian Peninsula) is crucial for a broad range of local/regional authorities, stakeholders, decision-makers, and researchers. The Guadalquivir estuary, as one of the largest and most productive estuarine systems of Western Europe, and the Bay of Cadiz, are two hotspots strongly affected by human-related activities which have undergone rapid agricultural, fisheries, touristic, and anthropogenic development. Specifically, intense turbid episodes are one of the main factors altering the functioning of both regions. The essence is that nowadays this coastal zone experiences a conflict between economy and sustainable environment, and there is a need for bridging knowledge in order to ensure social and ecosystem resilience. Traditional in-situ and modelling experiments have been developed, but new insights are required to assist the cost-effective accomplishment of water quality at synoptic and transboundary scales for the implementation of the European Marine and Water Strategy Directives.

The space based solution

A semi-automatic method based on the MultiSpectral Instrument (MSI) of Sentinel-2A at 10 m resolution is implemented to estimate Total Suspended Solids (TSS). Several field campaigns are carried out to collect in-situ measurements for calibration and validation of the regional multi-conditional model, which is developed with a switching method that automatically selects the most sensitive band avoiding saturation effects. Sentinel-2 scenes are downloaded from the Data Hub and atmospheric correction is incorporated into the framework through ACOLITE processor.

The semi-automatic model is routinely applied revealing improved mapping at unprecedented resolution (unachievable with traditional ocean colour sensors) along the estuary, the bay and surrounding waters (Figure 1). This methodology can robustly address small-scale monitoring due to the higher spatial resolution and band availability of Sentinel-2. In addition, it has demonstrated the feasibility to effectively estimate dredged-induced turbidity events during the periodic dredging activities of the shipping channel close to the Port of Seville (Figure 2). With this ongoing semi-operational system, the National Coastal Office and the Regional Government of Andalusia will be able to take advantage of Sentinel-2 time series.



Sentinel-2 image of Cadiz coast showing Total Suspended Solids concentration (mg/L) in the Guadalquivir estuary and Cadiz Bay, and tuna fishing "almadraba" in Barbate.

Credit: Copernicus Service information [2016-2017]

Thematic Area



CLIMATE, WATER AND ENERGY

Region of Application



ANDALUSIA - CÁDIZ

Sentinel mission used



S2

Copernicus Service used



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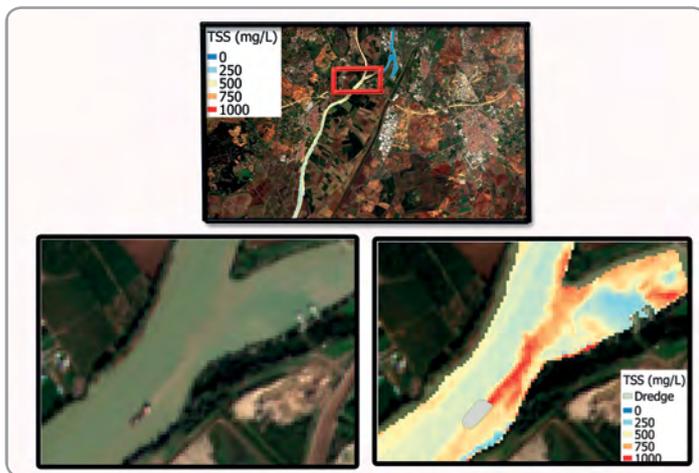
Usage Maturity Level



3

Benefits to Citizens

It is worth emphasising the benefit of assisting the services of local to regional initiatives for supporting ecosystem policymakers contributing to the challenging management of these highly sensitive regions. The findings have projections regarding other topics related to coastal management options, since the lower reaches of the estuary are adjacent to the Doñana National and Natural Park, the largest reserve in Europe. Sentinel-2 has also allowed the study of the historic tuna fishing "almadraba" in Barbate (Figure 1). In particular, the increasing demand for integrated guidelines and open access techniques by end-users and water managers is being evaluated, as they need to be reinforced before being able to actively ensure upcoming policies by the agencies of the Regional Government. The proposed methodology is thought to bring significant breakthroughs in the exploitation of Copernicus data along the 1000 km of the Andalusian coast.



Sentinel-2 image showing the turbidity plume generated during the dredging operations in the Guadalquivir estuary and Port of Seville and map of Suspended Solids in November 2016.

Credit: Copernicus Service information [2016-2017]

“Sentinel-2 will definitely help us to solve the challenging water quality monitoring along the coast of Cadiz, bringing new perspectives of applications into focus such as dredging-induced turbidity monitoring.”

*Gregorio Gomez-Pina,
National Coastal Office in Cadiz, Government of Spain*

Outlook to the future

Overall, these results encourage additional proposals relying on both operational Sentinel-2A/B. With the 5-day revisiting of the two satellites, by integrating the data sources into the workflow we will enter a new era for time series analysis at high spatial resolution. Likewise, further insights are needed to examine other water quality parameters such as chlorophyll-a in order to contribute consolidating Sentinel-2 data to operationally and routinely assist coastal zone management as a contribution to the local and regional water quality programmes.

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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.

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