

## SATELLITE IMAGERY FOR IMPROVED COASTAL MANAGEMENT

*Copernicus satellite imagery provides a new paradigm in earth observation thanks to regular, high quality imagery and accurate satellite derived products.*

### The challenge

The Nouvelle-Aquitaine region features more than 700 km of coastline and presents one of the areas with the most rapid demography mostly focused on the coastal area. Coastal ecosystems are driven by complex interactions where physical processes are controlled mainly by marine forcing ranging from seconds to decades, respectively for waves to tides, winds and seasonal river discharge changes and trends over time. Therefore, nearshore and coastal environments are among the most dynamic and constantly changing on Earth. Whilst these regions play a key role at the land and ocean interface, the state of the sea surface and especially wave breaking prevent easy and safe ground observations. Whilst field observations fail to be exhaustive due to their dynamical and unsecured patterns, frequent and synoptic observations acquired by multispectral optical satellite imagery enables adaptation of coastal observation strategies and management, both for scientist and end-users.

### The space based solution

Based upon ocean colour and image processing tools combined with artificial intelligence and machine learning, multi-spectral high-resolution satellite observations, including Copernicus Sentinel-2 optical sensor, allow accurate physical and biogeochemical parameters derivation. For example, they enable e.g bathymetric maps that cover the first 10 to 20 metres depth depending on the transparency of ocean waters and water constituent concentrations.

Accuracy of coastal morphological features positioning and change analysis can reach high performance achieving accurate erosional trends such as coastline change, only limited by the resolution of the space borne sensors. Lastly, in the very near future, remotely-sensed coastal indicators such as Sentinel-2 derived bathymetric

charts are to be compiled by the Aquitaine Coastal Observatory in order to derive more precisely the Aquitanian erosional trends and supply recommendations for coastal management support and local strategies in order to preserve coastal zone. Integrated coastal zone management at regional scales that experience coastal erosion issues fits perfectly with the Copernicus scope as it supports sustainable marine and coastal activities, and risk mitigation strategies.

Coastal monitoring is supported by either time consuming field surveys, spatially limited and restricted to calm sea states to ensure human safety, or costly airborne bathymetric Lidar surveys. Conversely, satellite earth observation is identified as a cost effective solution for large and long term monitoring of coastal systems and henceforth for deriving useful environmental parameters for decision making through regular and accurate mapping to ensure the safety of people and goods. Moreover, climate change impacts have to be addressed. Thus, coastal change analysis must be based on regular and accurate surveys of key indicators in order to distinguish local and short-term processes from long-term trends dedicated to forecasting the impact of future coastal hazard. Earth observation and ocean colour tools allow water constituent concentration to be characterised thanks to relative water transparency. These indicators are of importance for



Coastline detection and change analysis from 2013 to 2015 in Pavillon Royal beach, Bidart, Basque country, south-west France.

Thematic Area



CLIMATE, WATER AND ENERGY

Region of Application



NOUVELLE-AQUITAINE

Sentinel mission used



S2

Copernicus Service used



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Usage Maturity Level



3/4

coastal managers as they represent key indicators of the coastal morphology and water quality.

## Outlook to the future

The next generation of Copernicus and Sentinel satellite missions planned by the European Commission and the ESA will improve ocean colour applications dedicated to strategic defence and environmental issues as they combine high space, time and radiometric resolutions, for long-term perspectives. Coastal monitoring is also a key sector for the future of the blue growth and further sustainable worldwide economy.



Satellite derived Bathymetry of the Arcachon Lagoon, derived from Sentinel-2A imagery. Optically deep waters are represented in black.

*Credit: Contains modified Copernicus Sentinel data [2016]*

“The use of satellite data to enhance our knowledge and monitoring of marine ecosystems will contribute to the regional blue growth strategy we are currently launching.”

*Marie-Agnès Dupouey,  
Blue Growth at Région Nouvelle-Aquitaine*

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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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