European Commission

nereus
network of european regions
using space technologies

·e·esa
European Space Agency
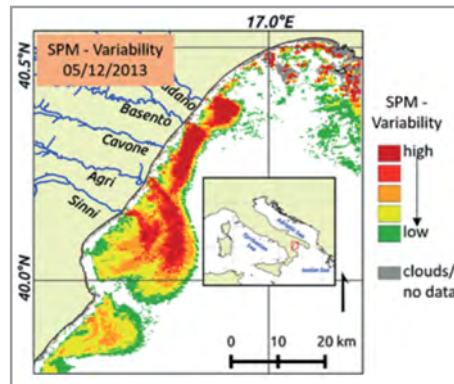
→ **THE EVER GROWING USE OF COPERNICUS ACROSS EUROPE'S REGIONS**

A selection of 99 user stories by local and regional authorities

opernicus
Europe's eyes on Earth

SATELLITE MONITORING OF SUSPENDED PARTICULATE MATTER

Monitoring anomalous events occurred at Ionian coasts of Basilicata Region by integrating frequent and detailed multi-source satellite data.

The challenge

River discharge affects Suspended Particulate Matter (SPM) dynamics and variability in coastal areas, contributing to the generation of possible environmental degradation situations. The coastal waters off the Basilicata Region (southern Italy – Ionian Sea - eastern Mediterranean) coastline are affected by the presence of five river mouths determining continuous water turbidity fluctuations that can modify the quality status of this complex coastal habitat. Only the implementation of a monitoring system able to detect the occurrence of any possible critical event, may allow a sustainable management of this region. Satellite data can be a useful tool for SPM variability monitoring, complementing traditional in-situ based methods.

The space based solution

A multi-temporal analysis of 13 years of Moderate Resolution Imaging Spectroradiometer (MODIS) data, based on the Robust Satellite Techniques approach (RST), was implemented to analyse the effect, in terms of SPM variability, of the extreme hydrological event that affected the area in December 2013.

In detail, daily visible MODIS data at 250 m

SPM variability for the Basilicata region costal water area for the MODIS image acquired on 5 December 2013.

of spatial resolution, have been firstly used to compute SPM concentration by adapting a standard algorithm to the specific local conditions. Afterwards, the RST approach has been implemented enabling automatic detection of anomalous SPM concentrations in the days just after the flood wave peak. More recently, data acquired by the MultiSpectral Instrument (MSI) of Sentinel-2A at 10 m of spatial resolution have been integrated in the proposed application. Using these data allowed for an improvement in the spatial resolution of the achieved results, providing detailed information in shallow waters close to the coastlines as well as during non-extreme events, such as those recently affecting the area.

Benefits to Citizens

Besides the investigation of a single event (e.g. December 2013), the proposed approach allowed for identifying areas where the occurrence of anomalous SPM concentration was more frequent during the month of December for the whole 2003-2015 period. Such information was very helpful for the Basilicata Region authorities because it

> **" The developed application allowed us to carry out effective real time monitoring of the Ionian Sea coastal water quality."**
>
> *Gerardo Colangelo, Basilicata Region officer*

provided them with information about the most critical areas that typically localised in front of the river mouths, have been affected by a water transparency reduction as well as by other phenomena, such as pollutant transport that could have affected the marine environment status. In the light of this, amongst the other possible users, aquaculture companies have found the achieved results useful in order to exclude the most vulnerable areas. Furthermore, the effect on the shoreline evolution of past dredging actions was reconsidered.
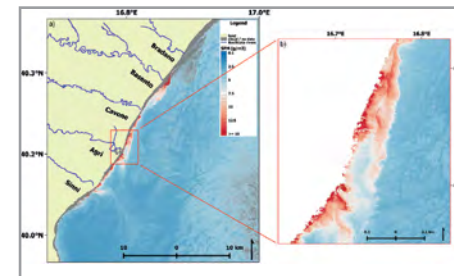
Example of application of MSI-Sentinel-2A data acquired on 30th April, 2018, for monitoring SPM in the investigated area.
Credit: Contains modified Copernicus Sentinel data [2018]

Outlook to the future

Data collected by the Ocean and Land Colour Instrument (OLCI), onboard Sentinel-3 satellite (operational since October 2016),

will be used in the future in place of MODIS ones. Its spectral features specific for ocean colour applications will guarantee an improvement in results in terms of sensitivity towards the discrimination of the different in-water optical constituents. Finally, it is worth mentioning that the proposed analysis should be extended to all the other calendar months to have a clearer view of the whole area, better discriminating most critical coastal zones in terms of SPM concentration values and variability. Moreover, the proposed approach can be easily exported to other geographic regions and coastal areas, with benefits for other Local Regional Authorities managing water resources.

Acknowledgements

T. Lacava, N. Pergola, V. Satriano[1] C. Di Polito, E. Ciancia, V. Tramutoli[2] and D. Doxaran[3]
1. Institute of Methodologies for Environmental Analysis, National Research Council, Italy
2. University of Basilicata, Italy
3. Laboratoire d'Océanographie de Villefranche, France
Email: teodosio.lacava@imaa.cnr.it