MARRE: A research project to monitor the Hellenic Seas using Remote sensing

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Abstract

The objective of the research proposal is the development of an open source GIS system for monitoring the marine environment by using satellite remote sensing data combined with field measurements (historical and real-time data). The development of such a system for Greece stems from the need to support national policies in areas of high interest such as the environmental status of the coastal zone and the wider marine environment. The products that will be monitored and assessed by the research project will include chlorophyll concentration, *Posidonia oceanica* meadows mapping and Potential Fishing Zones and other environmental parameters as salinity and turbidity. Automated process of receiving and analyzing the satellite data will be implemented and the generated products will be compiled into a central geospatial database where a series of services will be installed. These services will be based on open standards and architectures such as OGC cataloging, viewing and downloading services, or metadata specifications according to the INSPIRE protocol.

Keywords: remote sensing, GIS system, chlorophyll concentration, Potential Fishing Zones, biodiversity monitoring, ocean colour

1   About the MARRE project

MARRE is a research proposal for the development and establishment of an integrated open source GIS system for monitoring the marine environment. The services and products will be supplied by satellite remote sensing data combined with field measurements and they will be covering a wide range of modern scientific issues from the fields of ecology, fisheries management and physicochemical monitoring of the Greek seas. The project will provide fast, accessible and reliable information which formerly would require personal skills and actions for collection, processing and interpretation. Therefore, MARRE will contribute in faster decision making, addressing public issues as well servicing the private and non-profitable sectors.

The two main and innovative elements of the project arising from the combination of enterprises and research institutes are: a) the linking of field data with multiple-scaled remote sensing data (from a few centimeters spatial aerial imagery to terrestrial satellite spatial analysis of tens of meters) and b) the combination of information extracted from different types of data into an information system for monitoring the quality of the coastal and marine environment.

2   Data and field measurments

The project will develop innovative products to monitor the status of the marine environment using free satellite observation data. These new products will provide information on water quality and will be derived from the in-situ measurements of the participating institutions as well as from available data at European repositories. In particular, using high-resolution satellite data such as Sentinel-2 and Sentinel-3 data in combination with in-situ measurements at

Greek seas, essential environmental parameters such as chlorophyll concentration and turbidity will be assessed. Three data sources will be used: a) historical in-situ measurements of essential ocean variables such as, temperature, salinity, chlorophyll, ocean colour collected from HCMR in the frame of national and European research projects and archived in the Hellenic National Oceanographic Data Centre (hnodc.hcmr.gr), b) near-real time data of the HCMR Poseidon System, the Monitoring, Forecasting and Information System for the Greek Seas (poseidon.hcmr.gr), c) in-situ measurements from new research cruises that will be carried out in the Aegean Sea for the specific needs of MARRE project e.g calibration of the algorithms for the estimation of chlorophyll from satellite data using field measurements of high accuracy.

3   Methodology

The methodology for estimating Chlorophyll concentration, will focus on the combined use of satellite data and in-situ measurements and will evaluate and improve existing empirical algorithms as MEDOC4 and MEDOC4me. As a result, the derived products will be adapted to local conditions and the specific features of Greek seas. Importance will also be given to the monitoring of the marine biodiversity by the mapping and the monitoring of the Posidonia meadows. The satellite processing will be based on 4 pylars: a. Data acquisition, b. Preprocessing, c. Object Based Image Analysis (OBIA), d. Accuracy assessment. Finally, the potential fishing zones (PFZ) of the Greek seas will be extracted using the remotely sensed datasets of Sea Surface Temperature and Chlorophyll-a. Those parameters will be used for the extraction of the corresponding oceanic fronts and later the spatial distribution of pelagic fish will be extracted. A principal component analysis and a simple multicriteria analysis will be evaluated for producing the daily Potential Fishing Zone maps with real data.

The MARRE system platform is a collection of IT software and applications that will provide access to the information produced in the project. The platform is designed to follow the n-tier architecture to provide maintainability, scalability, flexibility, and availability. It consists of: a. A central database, which will store all the data produced during the project. b. Services, to access data and information derived from project. Since the project generates many spatial datasets, several of the services are related to spatial data access / process and are based on standards defined by the OGC: WMS, WFS, WCS, WPS. c. Applications, for the dissemination of the project's results, developed using open source software like GET SDI PORTAL, for the geoportal, and CKAN, for the open data portal.

4   Additional Information

More information about the progress of the project can be found on the official website at http://marre.gr/ in Greek. For additional information in English one can refer to https://mrsg.aegean.gr/?content=0&nav=59.