

Operational Data Management in Support of Search and Rescue Operations. Malta, Central Mediterranean Sea

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Distressed persons are transferred to a Maltese patrol vessel. Photo credit: US Navy.

Data in support of Search and Rescue Missions at Sea

In 2015 the number of Search and Rescue (SAR) operations surged in response to the humanitarian crisis of the massive exodus of migrants and refugees from Africa and Middle East entering into European waters. The success of a SAR mission relies on the availability of maritime and aerial resources to cover extended areas and the optimized use of such limited resources.

In turn, the planning for the deployment of SAR units relies on the amount and quality of information readily available. In the past decade, the oceanographic community has been significantly improving the metocean information available in near-real-time to end-users, making available both observational data (present time) and model-predictions (forecasts). Emergency responders truly benefit by this surge of available environmental information when such data are being integrated into larger frameworks - Common Operational Platforms (COPs). When multiple layers of dynamic information are being presented into a COP they provide added-value contents to end-users and significantly improve the decision making process.

This editorial presents an example of effective collaboration in the Mediterranean Sea between academia (University of Malta) and industry (RPS ASA) to support an end-user in charge of SAR operations in the region (Armed Forces of Malta). Presently environmental information generated by the sub-regional CALYPSO project is seamlessly provided to SAR operators via web-services; this met-ocean data can then be integrated into drifting models and search and rescue planning systems.

Data Distribution during Emergency Response and SAR Operations

To support emergency response, information should be seamlessly integrated into the responder's tools. Public authorities and industry are increasingly shaping the requirements of what is known as Common Operating Picture (COP): a digital framework based on Geographical Information System (GIS) technology that provides centralized point of data and information to help better understand a situation, and to coordinate and communicate emergency management and response personnel.

The marine SAR community uses tools to help understand a particular emergency situation, to predict its evolution and to organize the deployment of SAR units accordingly. RPS ASA has developed and provided SARMAP (Search & Rescue Model Analysis Program) to several SAR organizations worldwide and has assist-

ed the US Coast Guard (USCG) to develop their SAR Optimal Planning System (USCG SAROPS). Those tools integrate a drifting model that predicts the future position of an object or person from its last known position; they also include a SAR unit planning module to optimize the search by maximizing its probability of success based on multiple factors such as type of object, search method and environmental conditions. As such, metocean information becomes a critical input for both model(s) and the planning engine.

To serve SAROPS and SARMAP users, RPS ASA developed the Environmental Data System (EDS). The system operationally collects and aggregates data from a variety of national and regional data providers; these data are made available to operational users via web services requests. It uses Open Geospatial Consortium (OGC) Standards so data can be consumed by various platforms, web clients or desktop applications.

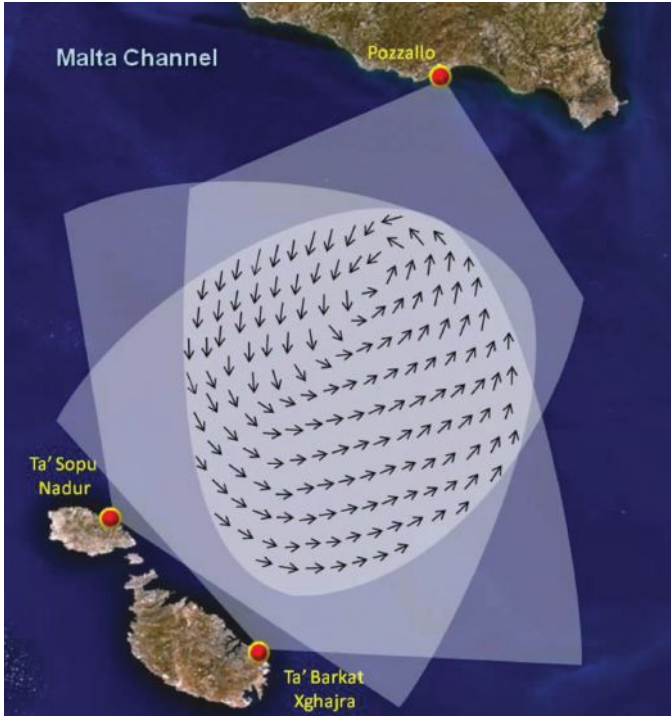
The EDS provides responders with real-time and historical environmental data, facilitating the visualization, analysis and consumption of such information through Web services. EDS daily connects to remote data providers for example in the US (NASA, NOAA, NAVY) and in Europe (MyOcean/Copernicus, UK MetOffice, Puertos del Estado in Spain). Every year dozens of new data sources are seamlessly being integrated into the EDS. The Quality Assurance (QA) procedure in EDS ensures data redundancy and helps improve the overall quality of the data by encouraging users to compare and contrast different data products.

The CALYPSO Project: New Data Sources in Support of AFM operations

In the past years, end-users and emergency responders have benefited from the consolidation of several operational oceanography initiatives; this is particularly true in the Mediterranean Sea with the EU based MyOcean and Copernicus (Earth Observing & Monitoring) and sub-regional projects like CALYPSO. One stakeholder benefiting from such international, regional and national scale initiatives is the Armed Forces of Malta (AFM) with access to an array of metocean datasets covering their SAR area of responsibility.

A common challenge that end-users typically face is the integration of such datasets into their operational tools. By means of EDS, RPS ASA has provided AFM's SAROPS users a range of metocean data products, including observations and model predictions. Starting from this year, and thanks to the collaboration of RPS ASA and the Physical Oceanography Research Group at the Dept. of Geosciences, University of Malta,

AFM SAR operators are leveraging the results of the CALYPSO project: high-resolution, near-real time observations and forecasting services that will help improve their SAR missions.



CALYPSO project: HF Coastal radar coverage north of Malta, Mediterranean Sea

The CALYPSO project is conducted by a partnership between Maltese and Sicilian research entities and national stakeholders led by the Maltese Physical Oceanography Research Group. The main deliverable is the operational HF radar observing system composed of CODAR SeaSondes for the recording (in real-time with hourly updates) of spatially distributed sea surface currents (at 3 km spatial resolution) in the strip of sea between Malta and Sicily. The system consists of two HF radar installations on the northern shoreline of Malta and Gozo, and two other radars within Pozzallo and Ragusa harbors respectively, on the southern coast of Sicily.

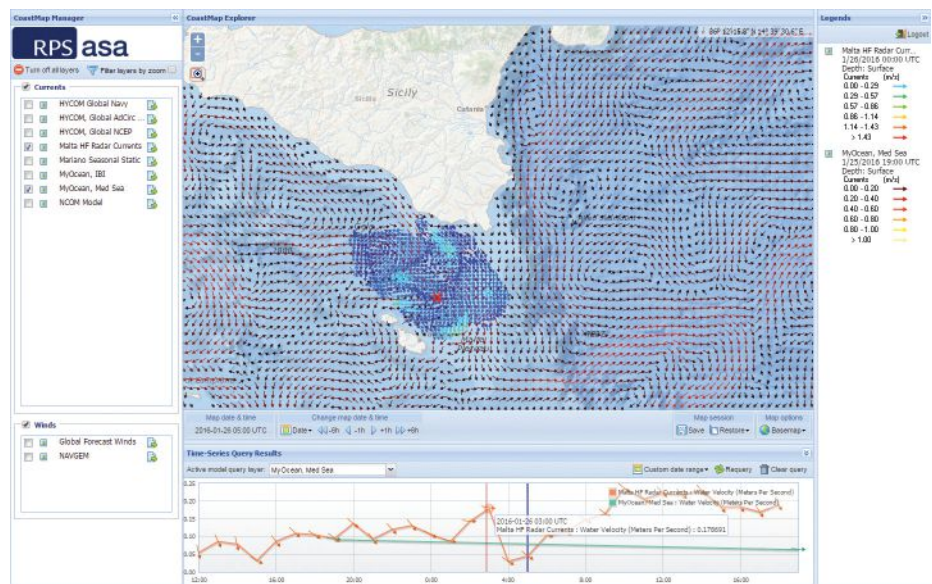
Data are elaborated by combining observations from each

station and published to subscribed users and the general public through dedicated web-services. In combination with numerical models forecasts, the HF radar data provide support to respond against marine pollution, assist SAR operations, and overall ensure a safer navigation. Coast guards, civil protection organizations and environmental protection agencies in both Malta and Sicily are the major beneficiaries of the CALYPSO HF radar network. The system is a highly-valuable monitoring system of cross-border interest a reliable knowledge of sea surface currents is a fundamental prerequisite for supporting responsible authorities especially in case of emergency response to marine oil spills in this busy area of maritime traffic in the Mediterranean, as well as for search and rescue operations. A new planned proposal will extend the coverage south of Malta to assist search and rescue operations in areas of higher concern due to irregular migration from northern Africa and hopefully to reduce the tragic loss of life at sea.

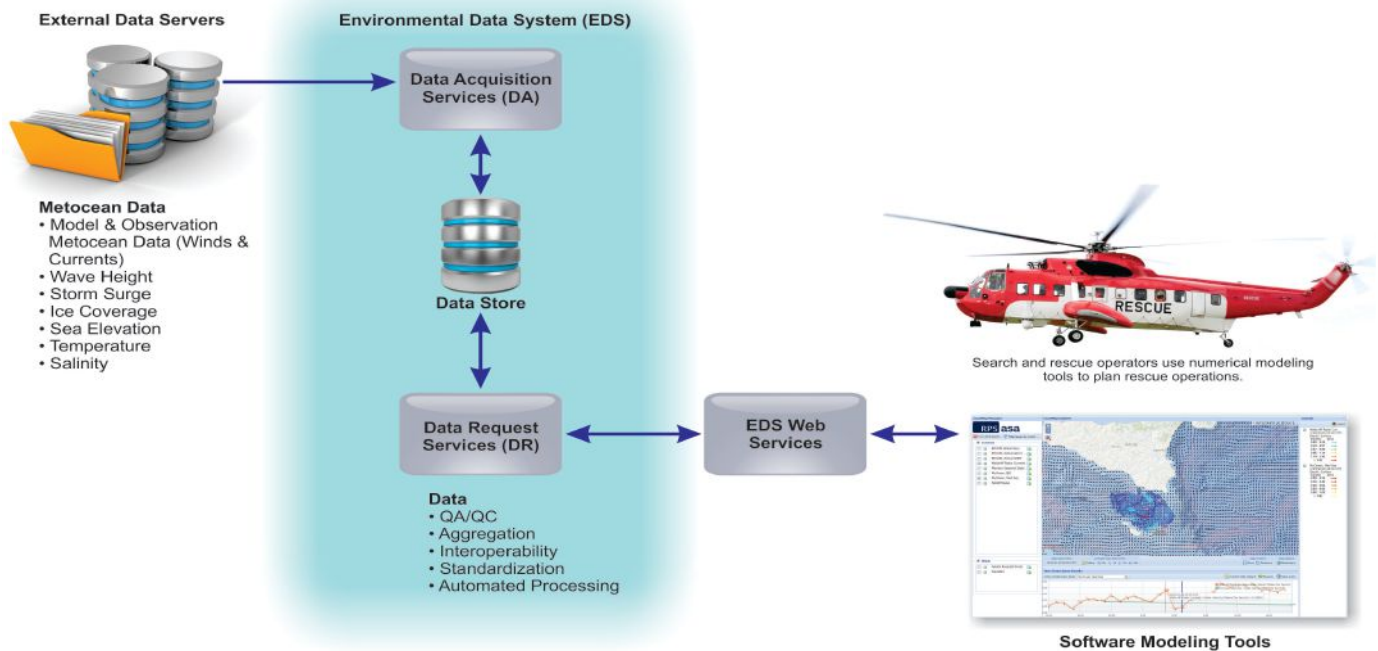
A smartphone application for both Android and iOS phones, called KAPTAN, provides an integrated service to mariners combining observed and predicted meteor-marine conditions; this service data stream is based on data deriving from the CALYPSO HF radars as well as from satellite observations and numerical models. It can be downloaded for free from Google Play and App Store on iTunes. The same services are also available online on www.capemalta.net/calypso/kaptan.

Operational Data Collection and Dissemination

In support of the SAR missions, AFM can access the data portal using the EDS Viewer for data analysis as



AFM access to EDS Viewer: a common platform to compare different current data products (MyOcean and CALYPSO's HF Coastal Radar); Malta, Mediterranean Sea.



Schema of operational data management. From Source to User: Making Ocean Data Operational. 1. EDS collects ocean and meteorological (metocean) data in a variety of formats from disparate sources, 2. EDS aggregates data spatially and temporally, which are archived for use in geospatial applications, 3. EDS provides specific data products to address client's needs, e.g. environmental analysis, weather/ocean forecast, emergency response, mission support & planning.

well as obtaining actual data subsets and aggregations in time and/or space to feed their SAR operational tools - SAROPS. As such, RPS ASA's EDS and EDS Viewer are the nexus of operational metocean data management for emergency responders.

The outcome, with the help of effective operational data management in the EDS, is metocean data that are consistent, retrievable, timely, and on deck—ready for the task at hand via standard web services. Operators are able to obtain the latest data that are useable in their preferred numerical modeling and mapping applications. Maintaining a single point for metocean information and integration for operations (tasks) allows managers to make sound decisions and operate effectively and efficiently. Visit our interactive map at oceansmap.com/eds.

The EDS is designed to be scalable and modular and utilizes a Service Oriented Architecture (SOA). Users access the available data by using a web service and the web service returns data based on the request. The service may return data to the user from data products stored in distributed servers, or a more common approach is that the catalog server retrieves data to a central server as a background processes so all the data are stored and archived on a central server. The base output format of the EDS is the CF-compliant Network Common Data Format (NetCDF), a self-describing, portable, array-oriented file format.

The EDS process of data collection and cataloging services allows administrators to customize the data to be made available to their client applications. The catalog server is a series of data collection services governed by a timing service that automatically collects, processes and stores data from any number of disparate sources according to source availability schedules. The services use metadata stored in database that tell the catalog server when and where to collect data from.

The EDS allows remote users to obtain the latest hind-cast and forecast of winds and currents data for their area of interest and specific time range just by making several clicks. The procedure includes: 1) the user makes a query to the EDS for the area of interest and the time range; 2) the server sends back the list of data providers and data products available for such area and time range; 3) once the user selects a data product(s), the server processes the request by generating on-the-fly customized file(s); and 4) user receives back the wind and/or current file that will be saved locally in the computer. The entire procedure takes typically less than a minute, and this immediate response is quite critical in supporting marine operations.

Acknowledgements

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