Environmental Data In Support of Search & Rescue Operations in the Central Mediterranean Sea

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• Applied Science Associates, environmental scientists and engineers, based in Rhode Island (USA).

• Member of the RPS Group plc since October 2011.

• ASA has been providing environmental modeling, data management services and scientific support for more than three decades to public & private sector.

• Developers of OILMAP/SARMAP/CHEMMAP, modeling and response tools provided to multiple Coast Guards worldwide.
Outline

• **Introduction & Motivation**: operational data delivery to responders

• **Search & Rescue (SAR)**: leveraging ‘better’ metocean data products

• Collaborative pilot project in Malta
  - **University of Malta** – EU Regional CALYPSO Project
  - **Armed Forces of Malta** – SAR Mission using SAROPS
  - **RPS ASA** – Data Management

• **Environmental Data Management**
  - EDS - Collection, Processing and Dissemination
  - Near-Real-Time Data Comparison (observations vs model)
  - SAR Cases (SARMAP)
Motivation:

Operational Data Analysis & Dissemination

• Metocean information must be available in near-real-time to emergency responders (SAR Operators) for their prediction and planning tools (e.g. USCG’s SAROPS and RPS’s SARMAP).

• Ocean mapping applications allows SAR Operators to do ‘on-the-fly’ evaluation of metocean data products and decide which sources are better suited to be used in a particular SAR case.

• Data from model predictions provides a larger spatial and time coverage (past/present/future). Meanwhile, observations (like HF Coastal Radar measurements) provide ground-truth information. Ideally, Operators would have access to both complementary types of data sources.
Challenges & Requirements

• Metocean information helps understand and predict a particular situation, whether it is a pollution, missing people at sea or tackling other emergency.

• SAR Planning, Emergency Response, benefits from having all information being integrated into operator’s response tool/system, whether it is a simple GIS or more sophisticated – COP (Common Operational Platform)

• An increasing amount of data sources to monitor and predict the marine environment. But the challenge is to seemingly integrate this data stream into user’s COP.

• Benefits of data redundancy/complementarity: the data distribution and/or the COP integration should encourage data comparison
Malta – Operational Oceanography applied to Search & Rescue (SAR)
Malta – Government & Industry Partnership

• University of Malta (CALYPSO EU Project) <> Data Generation

• RPS Ocean Sciences (RPS ASA) <> Data Providers

• Armed Forces of Malta (SAROPS Users) <> End-Users
University of Malta - CALYPSO Project
EU & Regional applied research partnership

• CALYPSO EU Regional Project

• Operational Oceanography implemented thanks to Maltese and Sicilian/Italian stakeholder engagement

• Infrastructure for meteo-marine observation (HF Radar) and current forecasts

• Added value services to a range of users
University of Malta - CALYPSO Project
HF Radar current observations & Model Predictions

• Fully operational HF Coastal Radar system in the Malta-Sicily Channel: real-time measurement of sea surface currents and waves.

• Mapping sea surface currents in real-time with hourly updates at 3 km of spatial resolution.

• Malta’s HF Radar data is made available to users (AFM) via RPS’s EDS.
University of Malta - CALYPSO Project
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University of Malta
Ocean circulation modeling

- POM – Open waters, Malta-Sicily channel
- Downscaling from large scale model results (MyOcean)
- Data assimilation (HF Radar observation)
- ROSARIO-SHYFEM near the coast (triangular mesh)
University of Malta
Coastal circulation modeling

- ROSARIO-SHYFEM near the coast (triangular mesh)
University of Malta
Data dissemination to the general public

• Targeting public non-professional users

• Smartphone app – KAPTAN

• Expanding the user-base, to promote the use of HF radar observations

• Services for Android and iOS
University of Malta

Future developments

• Expanding the coverage to the south
• Improving the coastal circulation (data assimilation)
Armed Forces of Malta (AFM) Search & Rescue Missions

- AFM has been using SAROPS software in support of their SAR missions (US Coast Guard’s SAR Optimal Planning System). SAROPS requires met-ocean information as inputs for SAR cases and resource planning.

- RPS ASA assisted USCG in deploying SAROPS in Malta and has been providing operationally access to metocean data via EDS (Environmental Data Server). This includes winds & currents data for Malta’s SAR Responsibility area.

- Drifting model predictions and resource planning heavily depends on input data availability and quality (accuracy). Univ. Malta collects, generates and disseminates high resolution coastal information, key to improve the data needs in the region.
Armed Forces of Malta (AFM)
Integrating metocean data into SAR Tools
Armed Forces of Malta (AFM)
SAR Operation steps

• Understand conditions at sea, present and future: Operator downloads metocean data past/present/future (animated with time-slider)

• Search area: identify ‘most likely’ location of missing person(s) or objects based on model-predicted drift model. Search area depends on object type & environmental conditions.

• Search pattern: based on set patterns, environmental conditions (visibility) and SR Unit availability and endurance.

• Probability of success: combination of probability of detection (type of search, object & visibility) and probability of containment (based on search area).
RPS ASA (RPS Ocean Sciences)
Operational Data Management for End-Users
RPS ASA (RPS Ocean Sciences)
Operational Data Management for End-Users

Tools
OILMAP - Oil Spill
MUDMAP – Drilling Discharges
CHEMMAP/AIRMAP - Chemical Spills
SARMAP – Search & Rescue
EDS - Environmental Data Server
Data Portals, mapping/visualization
OceansMap – MetOcean Data Analysis
OIL/SARMAP WebGIS - Web-based Models

Data
Met-Ocean
Remote Sensing
Vessel Traffic, AIS
Operational Forecasts
In-Situ Measurements
Historical Model Output
Habitat / Environment description

Risk Analysis
Training, Drill Exercises
Biological Characterization
EIA / Contingency Planning Support
Natural Resource Damage Assessment

Operations
Planning

Oil & HNS Spill Forecasting Systems
Search and Rescue Operations
Operational Metocean Data Provision
Spill / Drill Exercise Response Support
Data management – Collection

Client Application
- Web user, ASA*MAP

XML REQUEST
- Geographic region
- Data Start & End time
- Type / data product

EDS Data Services
- Aggregation, time & space
- Aggregation, multiple data products
- Data conversion (into NetCDF)
- Objective Analysis

Catalog Server
- Catalog

Remote Data Source
- Image File
  - Image (WMS)
  - XML (WFS)

Data Catalog (as per user request)
- NetCDF File, CF 1.0
- Gridded format
- Unstructured Grid
Applications

Client Application
Web user, ASA*MAP

XML REQUEST

Catalog Server
Remote Data Source

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Data Catalog
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RESULTS

Image File
- Image (WMS)
- XML (WFS)

- Geographic region
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- Type / data product
EDS – Environmental Data Server

- Data Acquisition (Catalog Server)
- Data Storage (Data Store)
- Data Request (EDS web services)
EDS – Environmental Data Server

• EDS was developed and implemented to serve data operationally to the USCG’s SAROPS program. It collects and manages a wide variety of oceanographic and meteorological data products from a large variety of sources, both observations and model predictions.

• Data from the EDS is being accessed on-line and used worldwide by the SAR operators and other organizations in charge of marine emergency response (e.g. USCG, Sasemar, Irish CG, MCA, AFM, EMSA)

• Currents and winds model predictions are available in near-real-time to SAR operators for their SAR modeling tools (ex SAROPS and SARMAP) via on-line requests to EDS.
Why EDS?
CALYPSO HF Radar in EDS Viewer
CALYPSO HF Radar in EDS Viewer

Legend

Date & Time

Zoom

Currents

And

Wind

Malta HF Radar Currents

Marano Seasonal Static

MyOcean, IBI

MyOcean, Med Sea

NCOM Model

Global Forecast Winds

NAVGEM
Data Comparisons using EDS Viewer
Data Comparisons using EDS Viewer

View Time Series
Using HF Radar in Search And Rescue Planning

1. SAR exercise simulation parameters:
   - Date: November 1\textsuperscript{st} 2015
   - Location: 36.2 N, 14.6 E
   - Time of Incident: 12:00 AM

2. SAR simulations using different current data inputs (HF Radar – observations, HYCOM & MyOcean – model prediction). Two different SAR modeling/tools (SAROPS & SARMAP).

3. SAR Operator can compare results using different data inputs, helping him/her make informed decisions.
SAROPS & SARMAP – Obtaining data via EDS