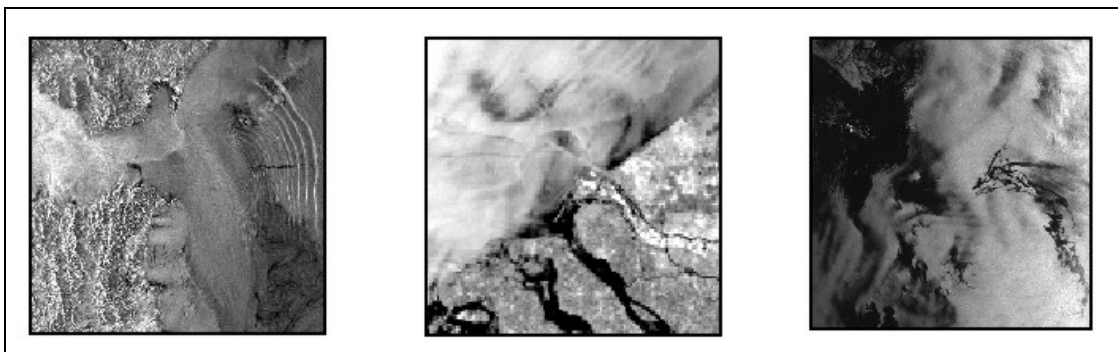


# MARSAIS

*Marine SAR Analysis and Interpretation System for application to the coastal zone*  
(<http://marsais.ucc.ie>)



## **Introduction to SAR**

Spaceborne Synthetic Aperture Radar (SAR) has the unique capability to provide a high-resolution image of the roughness distribution at the ocean surface at any time of the day and independent of weather conditions. The SARs aboard the European satellites ERS-1 and ERS-2, which were launched in 1991 and 1995 respectively, provide images of the Earth's surface with a spatial resolution of 10m and 25m and a swath width of 100km. SAR images from the Canadian RADARSAT-1, launched in 1995, have a resolution between 10m and 100m and a swath width of up to 500km. In 2002, the European Space Agency launched ENVISAT with the Advanced SAR (ASAR) instrument, offering a variety of resolutions, swath widths, and polarisation modes.

### **• SAR in the Coastal & Marine Environment**

The technology for processing and extracting geophysical quantities from SAR data is mature, with validated algorithms and models for important oceanographical phenomena like winds, waves, currents and oil slicks.

This makes SAR imagery suitable for a number of marine applications, ranging from support of near real-time operations to use in long-term planning. The MARSAIS project focused on **sea state** (wind & waves), **current and frontal features**, **oil spill/slicks** and **synergy** between SAR data and other EO data.

## **The MARSAIS Project**

The project aimed to design and implement a prototype generic **Marine SAR Analysis and Interpretation System (MARSAIS)** with sufficient product accuracy and optimum resolution for specific application to the coastal and marine environment. This was achieved by generating a series of MARSAIS sub-systems including:

- **The MARSAIS Database** - a web enabled database of multi-source satellite data implemented in IDL on the Net (ION).
- **The MARSAIS Toolkit** - a series of selected algorithms and models implemented in IDL. The toolkit demonstrates different geophysical parameters that can be derived from SAR data alone or from synergy with other EO data types, model and *in situ* data.
- **The MARSAIS Prototype** - a web based demonstrator

The prototype contains products, data sources, algorithms and models, validation information, introductory and didactic material for SAR data and other EO data. The prototype is implemented in HTML, CSS & JavaScript.

The prototype web site (<http://www.nersc.no/~marsais/prototype/>) also contains additional material in the form of fact sheets on each of the focus applications of MARSAIS. The content of the prototype site is applicable to a wide range of end users e.g. students, novices, experts, researchers.

## **Achievements**

### **• Wind and Waves**

SAR data can provide detailed quantitative local wind information. MARSAIS validated algorithms (CMOD-4 & CMOD-IFR2) for the extraction of wind speed from ERS SAR & Envisat ASAR data. For waves, MARSAIS contributed to the development and validation of a new algorithm (ENVIWAVE) for the extraction of wave parameters (height, direction and period) from Envisat ASAR data.

### •Current and Frontal Features

A direct outcome from MARS AIS are new algorithms for the estimation of surface current parameters across ocean fronts and internal waves. SAR data can provide current feature estimates including, surface current gradients over shallow water bathymetry, converging and diverging current systems, mesoscale eddies and internal waves.

### •Slicks

Within MARS AIS enhanced algorithms for the detection and classification of oil spills were developed and validated for both ERS SAR & Envisat ASAR imagery. In addition, an oil drift model was successfully included and tested for the eastern Mediterranean Sea.

### •Synergy

The combination of data from several sensors and satellites can make an important contribution to coastal & marine monitoring. As well as increasing the spatial and temporal coverage, this synergy also offers opportunities to advance the analysis and interpretation of remote sensing data. MARS AIS produced an interactive toolkit developed for comparative analysis of multi-source satellite data (radar, visual & IR).

## End User Assessment

A pivotal component of MARS AIS was the assessment of user requirements for SAR data in the coastal and marine environment. MARS AIS identified and involved potential end users of SAR data and generated end user feedback which in turn was fed into the development of a MARS AIS prototype focusing on sea state, (wind and wave), oil spills/slicks, surface currents (and internal waves) and synergy.

MARS AIS generated end user feedback and fostered interaction with end users from the coastal and marine community by:

- Disseminating a questionnaire on the use of SAR data.
- Communicating directly with individuals via phone/e-mail and utilising mailing lists to promote MARS AIS activities.
- Attending conferences and trade events over the course of the project.
- Hosting three dedicated workshops on the use of SAR data in the coastal and marine environment.

Among the key findings of the interaction and response from the end users the following are highlighted:

- The issue of cost was cited as a significant limiting factor in the use of SAR data.
- Capability (training and skills) and capacity (infrastructure) also influence the use of SAR data in the coastal and marine environment.
- There is potential for the further development of SAR data through continued basic and applied research into SAR applications in the coastal and marine environment.
- The examination of current features, shallow water bathymetry and pollution incidents were the preferred applications.

The findings and recommendations emerging from MARS AIS are of relevance to GMES. Detailed analysis of the end user feedback is contained in the **User Requirements Document**.

## Project Partners

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