Mecklenburg Vorpommern

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Ship Detection Service

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Abstract

The European Maritime Security Service, MARISS is the first phase of a pan-European activity of ESA (European Space Agency) under GMES (Global Monitoring for Environment and Security). The objective of MARISS is the development of integrated maritime and costal services to support European regions.At the DLR site in Neustrelitz (Mecklenburg-Western Pomerania), an application for ship detection based on satellite image data of synthetic aperture radar (SAR) from ERS2, ENVISAT and TerraSAR-X has been developed and implemented.

Regional Objectives for Application of GMES

The priorities for the EU Integrated Maritime Policy are the improvement of maritime safety and security, reduce pollution and to fight against illegal activities. A special objective of MARISS is to characterize the added value from combination of satellite based Earth Observation data with conventional data streams such as AIS (Automatic Identification System).

In this context there are common regional and national interests for developing and extending Near Real Time (NRT) Services for maritime applications. The location of the Neustrelitz Ground Station provides excellent real-time facilities for regional, national and international users.

The approach for the MARISS Service Network is based on a cooperative network, composed of a set of NRT Ground Receiving Stations covering specific areas with specific sets of sensors. Service Providers may then use the network to improve products and provide cost efficient services compliant with customer requirements.

As Figure 1 shows, the acquisition circle of Neustrelitz (appr. by elevation of five degree) allows coverage from the North Altlantic to the Mediterranean Sea. The primary regional focus is to provide ship detection services covering the German Bight and the Baltic Sea. Neustrelitz is the exclusive Ground Station in Europe for the German Radar Satellite TerraSAR-X.

Results

Satellite data are processed in real time. Data reception and real-time processing are carried out at Neustrelitz using an applied algorithm, developed by DLR's Institute of Remote Sensing Technology. Dependent upon the data resolution of satellite images, image and other products can be delivered within 12 minutes. See Figure 2.

Terrestrial AIS data for the Baltic Sea are acquired via the network and stored at the Ground Station and merged to the SAR images during processing.

Figure 1. Ground Station Neustrelitz, acquisition circle for ERS2 and TerraSAR-X; 5 degree elevation

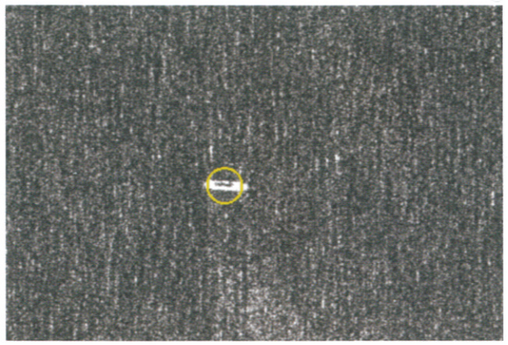

Figure 2. Detected ship on TerraSAR-X image data sub scene; Image Mode StripMap, resolution 3 meter

GMES Domain MARITIME

The detection service provides information such as the position, length, and direction of the ship. The fusion with AIS data from terrestrial and satellite sources creates a more significant picture with additional information e.g. ship name, ship class and destination. AIS messages are broadcast and regulated for all vessels larger than 300 GRT.

The product delivery to the user is established in the following way.

Products such as quicklook images, text files with ship position and kml file for loading in Google Earth are delivered via auto generated e-mail. (See Figure 3) The full resolution product is available for download on the delivery server user account.

Successful AIS experiments using ERS2 and TerraSAR-X data were conducted in different areas, including the Baltic Sea and German Bight.

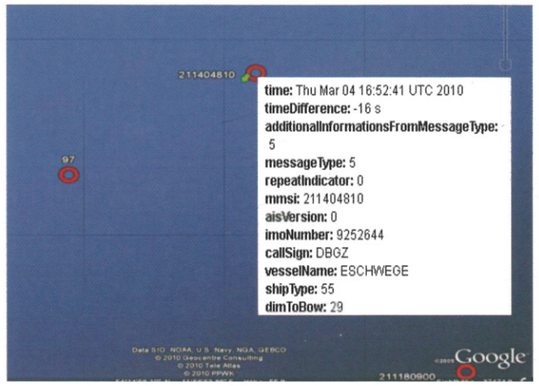

Figure 3. kml output product extract; image data product merged with AIS data; Google Earth used for product illustration

Operational Status of the Activity

The development of the application and service is ongoing. According to an effective maritime surveillance and tracking the integration of different, complementary data streams are mandatory. Satellite SAR and AIS are only two of the data streams of possible interest. Vessel Monitoring System (VMS) and Long Range Identification and Tracking System (LRIT) are further options.

The integration of other satellite data like ENVISAT will increase the reliability of the service.

Added Value to the activity provided through GMES

Coastal-based surveillance systems are widely used, but are limited in their coverage. SAR Satellites provides the possibility for ship surveillance over wide areas independent of weather conditions, cloud cover and daylight. Different SAR modes with different area coverage can be selected to obtain images over larger areas or with higher resolution according to the size of target ship.

With TerraSAR-X, very high resolution SAR images (up to 1meter) are available.

Future developments and Needs

In order to overcome the limits of terrestrial AIS, a Satellite-based AIS is under development and will be integrated if available. To provide users with easy and fast data access further harmonization of services with existing the exchange formats is necessary.

The main objectives of the MARISS project to create a Coordinated Service Network to provide all the European Users Organizations with integrated ship detection Services will take this into account.

One of the project aims is the standardization and best practices adopting within the maritime sector.

This needs further development to conform to existing regional and national user interfaces

Participants:

QinetiQ, FFI, ELMAN, DLR, SPACE HELLAS, LUXSPACE, gmv, CLS, e-geos, ASSYSTEM, EDISOFT,KONGSBERG, ITD

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