

COASTAL WATERS RESEARCH SYNERGY FRAMEWORK (Co-ReSyF): PROJECT OVERVIEW AND SAR-BATHYMETRY ESTIMATION

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Abstract

This paper presents the Coastal waters Research Synergy Framework (Co-ReSyF) project, which aims at developing a framework (cloud platform) that simplifies the incorporation of EO data into coastal research, and eases and supports diverse applications by coastal experts. It is further detailed one of the applications to estimate the coastal bathymetry from SAR-imagery.

Keywords: Earth Observation; Synthetic Aperture Radar; Bathymetry; Satellite Image.

1. Introduction

Coastal areas are exposed and subject to several natural risks, and represent a region where the majority of the world's population, infrastructures and economic activities are concentrated. Consequently, the National Authorities frequently highlight the need to monitor the coastline and the coastal zone bathymetry. Simultaneously, Earth observation from space has become a preferred method for the monitoring of extensive coastal areas. Its low cost (per unit area) can be highly rewarding when compared with traditional methods such as aerial photography or in situ surveys. Moreover, in highly energetic sandy coasts, the underwater morphology can change significantly at storm timescales, compatible to satellite revisiting periods.

2. Co-ReSyF Project Overview

The Co-ReSyF (Coastal waters Research Synergy Framework) aims to facilitate access to Earth Observation (EO) data and various processing tools by the coastal and oceanic research community, towards the future provision of services based on EO data. Co-ReSyF will deliver a (computational, on-line, web-based) platform supporting the development and use of applications, tailored ultimately to sustain and monitor economic and social coastal activities (e.g. fisheries, harbour operations, ship traffic monitoring, oil spill detection). This platform, based on cloud computing to maximise processing effort and task orchestration, will allow combined data accessing, processing, visualisation and output, all in one place (figure 1).

A set of coastal Research Applications (RA) are being implemented within the Co-ReSyF platform during the setup of it, namely: bathymetry determination from SAR Images; bathymetry determination, benthic habitat classification and water quality from optical sensors; vessel and oil spill detection; hyper-temporal optical data analysis; and ocean coastal altimetry. An open call to the scientific community outside the project has also been conducted, in order to allow for other applications to be developed and enhance the platform usage.

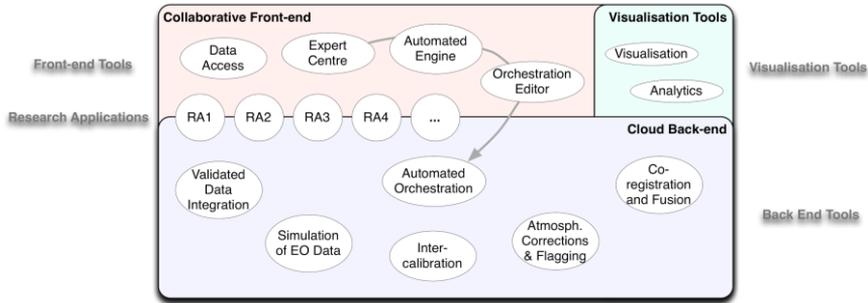


Figure 1. Diagram showing the various components and their interdependence within the Co-ReSyF project (credits to Deimos Engenharia, S.A.).

3. SAR-Bathymetry Application

The SAR-bathymetry application aims at deriving coastal bathymetry from SAR satellite data. The application is based on the detection of the swell wave pattern (wave crests and troughs) in SAR images (Fig. 2a) that, by means of image-spatial mathematical transformations (e.g., FFT), enable the detection of the local ocean wavelength. Presently, the method uses the linear dispersion relationship to relate the (peak) wavelength with the underneath water depth (Fig. 2b). This step also makes use of wave period estimates, determined from in-situ and/or model-hindcast data. The output of the algorithm consists in a DEM (Digital Elevation Model) for the target area, and/or a geo-referenced map with bathymetric contours computed from the DEM.

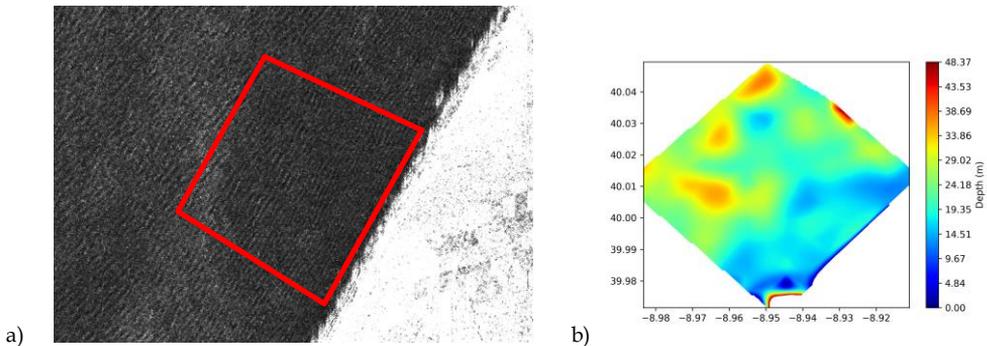


Figure 2. a) Example of a Sentinel-1 SAR-image for a selected area, south of Figueira da Foz; b) Estimated depth for the selected region at the left.

Acknowledgments

The Co-ReSyF project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 687289. The authors acknowledge the Korean Aerospace Research Institute (KARI) and SI Imaging Services (SIIS) for providing KOMPSAT-5 images.