BATHYSAT:
A processing chain for operational production of qualified SDB (Satellite Derived Bathymetry) at large scale

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The new generation of satellites and easy access to a large number of high-quality calibrated imagery (e.g. Copernicus program, constellation of Pleaides satellites) have driven progress in the field of remote sensing methods, such as SDB, over the last decade. As a user and producer of SDB, Shom decided to evaluate the performances of the state-of-the-art bathymetry estimation methods from satellite optical imagery.

The objective is to extend use cases to meet the expanding needs for bathymetric data in coastal areas. The two main challenges are:

1. Producing an SDB model without using any in-situ bathymetric data
2. Being able to estimate the reliability of the products

A solution based on the inversion of a radiative transfer model linking the remote sensing reflectance to the optical properties of water constituents, sea bottom and water depths has been selected. The solution was proposed by a consortium of organizations including Hytech-imaging, ENSTA Bretagne, iXBlue, and Airbus DS. A semi-automatic tool has been proposed in order to guide the operator to the best parametrization of the processing chain. An innovative error estimation model, based on a statistical inference model has been developed in order to estimate the bounds of the uncertainties, thus allowing the results to be quantitatively qualified. The Bathysat chain also allows expert users to get intermediate information and products, in order to be able to trace the process and build a critical expert view on the results produced.

The operational capabilities of the new production workflow have been validated on various test areas using available lidar and echosounders datasets. The preliminary results show the ability of the solution to produce SDB without any in-situ bathymetric data under some conditions (image quality, atmospheric conditions, turbidity and seafloor complexity). Even though the precision of the uncertainties estimation remains a challenge, the solution allows the local convergence of the inversion algorithm to be assessed, and provides a better understanding of the different factors of uncertainties.

A client / server architecture using cloud resources is being developed and progressively deployed over the Shom information system. The upcoming industrial phase of Bathysat will allow upscaling and large scale qualified SDB to be generated, as well as reactive SDB to be produced on demand.

Shom and Hytech-imaging will both operate the Bathysat processing chain for their own civilian, Defense, and commercial needs, thus leading to increase the production of innovative qualified hydrospatial products.